

RADICAL EXCISION AND DELAYED RECONSTRUCTION OF A LYMPHEDEMATOUS LEG WITH A 15 YEAR FOLLOW-UP

G.A. Dumanian, J.W. Futrell

Department of Plastic, Reconstructive, and Maxillofacial Surgery, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

ABSTRACT

An adult female patient with primary lymphedema of the lower extremity was treated with total excision of the subcutaneous tissues followed by delayed reconstruction with a giant full thickness skin graft taken from the excised surgical specimen. The leg has maintained excellent function and contour over the ensuing 15 years. A small area on the dorsum of the foot that initially was covered with a split thickness skin graft required subsequent regrafting using abdominal skin. This area developed verrucoid changes.

The radical surgical excision of lymphedematous tissue with wound coverage by skin grafts is one approach to improve the function and cosmesis of a swollen extremity, although the long term results are often questioned (1,2). We present a single patient with long term follow-up which demonstrates an effective and permanent surgical treatment of lower extremity lymphedema.

Over many decades, numerous surgeons have described direct surgical excision of lymphedematous tissue. Operative techniques have differed on the method of wound closure. Sir Havelock Charles is regarded as the first to "detail" the management of lower extremity lymphedema with radical excision (3). Wound coverage was achieved with split thickness skin grafts, although the skin graft donor site was not specified (4).

In 1959, Edgerton treated nine patients

with lower extremity lymphedema with radical excision and delayed skin graft coverage. In these patients a full thickness skin graft was harvested from the surgical specimen. The skin graft was stored for several days before placement on the wound to allow for wound hemostasis and granulation (5,6).

CLINICAL EXPERIENCE

During the past 19 years, the senior author (JWF) has selectively treated four patients with primary lymphedema of the lower extremity in the manner of Edgerton. Two patients initially successfully treated have been lost to follow-up. A third patient has a healed leg wound with only a ten month follow-up. The fourth patient is the subject of this case report.

OPERATIVE TECHNIQUE

Several weeks before the operation, strict leg elevation and hygiene are stressed. Under general anesthesia and tourniquet control, a medial incision is made down to the level of the muscle fascia. The skin and subcutaneous tissue are removed in one piece from the involved extremity with a combination of sharp and blunt dissection. The skin and subcutaneous tissue are excised down to the fascia lata, crural fascia, extensor retinaculum, and tendon sheath. The sole and plantar aspect of the toes are not excised. At the cephalad boundary of the excision, skin is

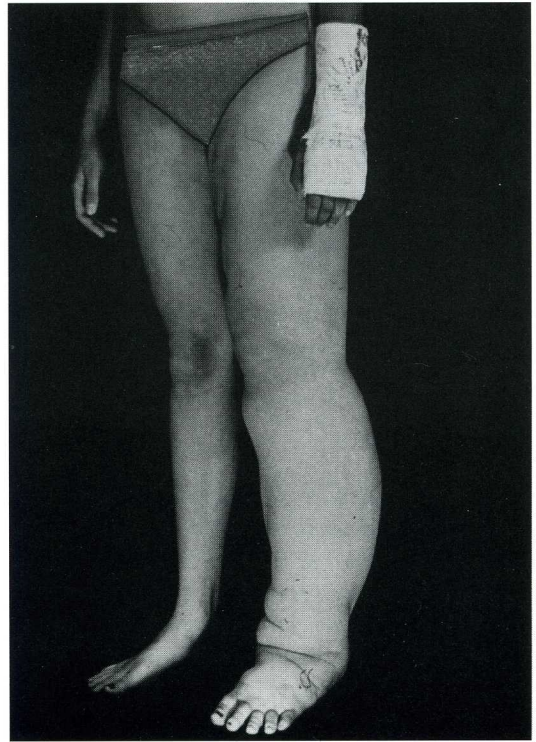
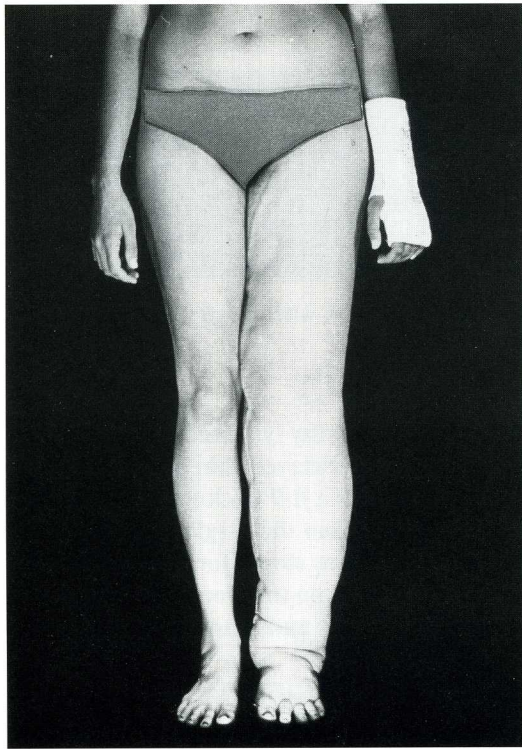


Fig. 1. 24 year old woman with primary left leg lymphedema after one week of hospital enforced elevation and compression therapy.

tacked to muscle fascia in order to produce a smooth contour.

The excised wound is covered with a non-stick bulky dressing moistened with antibiotic solution and wrapped with an ace bandage before deflation of the tourniquet. With the patient out of the operating room, the surgical specimen is converted into a giant full thickness skin graft with Mayo scissors, a process that may take several hours. The skin is placed free floating in 500 ml of a colloid solution and cold stored at 4°C.

Seventy-two hours later in the operating room, the dressing is removed and a dilute topical epinephrine solution is applied to control oozing from the fine granulation tissue now present. The skin graft is tailored and stapled into position under tension. After volume reduction, less than one-half of the full thickness skin is required for complete

wound coverage, making it possible to use only the most normal appearing skin portion of the excised tissue. The extremity is then wrapped snugly in a gauze dressing and immobilized. Redundant skin graft which is not used is returned to cold storage.

The patient is kept at strict bed rest with exaggerated extremity elevation for one week, and only limited progressive dependency with strict external support is allowed until three weeks after the operation. Any area of graft "non-take" is regrafted early during the initial stay in the hospital.

CASE HISTORY

A 39 year old woman had presented with primary lymphedema of the left leg 15 years earlier. It was minimally responsive to compression treatment and a previous wedge



Fig. 2. Appearance 15 years after radical excision and skin grafting (see text for details).

excision of skin and subcutaneous tissue. She also had had several episodes of cellulitis and lymphangitis. Pre-operative photographs were taken after one week of strict hospital-enforced leg elevation and compression (Fig. 1).

Fifteen years after radical excision and split thickness skin grafting her leg is of near normal contour and appearance (Fig. 2). She has not altered her lifestyle (e.g., elevation of the leg), but she wears a compressive stocking when ambulating. The skin of the leg remains soft and pliable and near-normal in appearance. Hair growth is similar to the unaffected contralateral leg. Spontaneous cellulitis has not recurred.

At the time of the original operation, a 7 x 5 cm area of skin graft was lost from the dorsolateral aspect of the foot, and this wound was re-covered at the time of the initial hospital stay with a split thickness skin

graft. The site was later regrafted to improve contour, most recently with a full thickness graft taken from the lower abdomen. This area on the foot, however, has developed verrucous changes (Fig. 3).

COMMENT

The radical excision of lymphedema with staged reconstruction by a full thickness skin graft brings together three separate spheres of clinical and experimental work. These are the surgical management of lymphedema, delayed wound closure, and the storage of skin grafts.

Beginning with Sir Havelock Charles, several trends regarding wound closure after the direct excision of lymphedematous tissue were notable. One trend was to reduce skin graft donor site morbidity. The skin graft



Fig. 3. Hyperkeratotic verrucous skin of dorsum of the foot.

donor site was moved from the thigh and abdomen of the patient (7) to the skin of the surgical specimen (8). Another trend was to enlarge the size of each skin graft. The skin grafts initially were harvested in many small pieces and joined like a patchwork quilt (9). Later, the grafts were taken as three long strips and then joined (10). Edgerton used the skin as a single graft. A third trend was toward increasing the thickness of the grafts. Skin grafts were initially harvested as split thickness grafts, and later they were taken at "almost full thickness" (10). Finally, the grafts used were harvested as full thickness grafts after removal of the subcutaneous tissue (5).

Skin graft thickness is thought to affect long term outcome (5). Split thickness grafts used after lymphedema excision have been

associated with severe chronic infections requiring amputations in some patients (1). Dellon noted the long-term superiority of full thickness grafts in 12 patients who had undergone lymphedema excision and grafting. Full thickness grafts had the best cosmetic results, whereas split thickness grafts demonstrated "verrucous, hyperkeratotic skin over the ankles and dorsum of the feet" (11). Thickness of the dermis seemed to be critical. An observation from our patient is that a full-thickness abdominal skin graft became verrucous while the full-thickness leg skin did not.

Rapid inosculation of full thickness skin grafts is more critical than for split grafts, making it theoretically more problematic to achieve a complete take with the thicker skin (12). *Delayed* skin grafting employed in the staged reconstruction of the lymphedematous leg wound addresses this concern (13,14). In a rat model, delayed skin grafting was shown to result in more rapid inosculation of skin grafts and a more complete graft take (15). Clinically, the main difference made by a 72 hour delay in skin grafting was the appearance of granulation tissue on the surface of the crural fascia.

Delayed reconstruction necessitates skin graft storage (16,17). In the patient reported, skin was stored in a colloid solution which contained a first generation cephalosporin. Experimental work has demonstrated a 50% skin graft survival at 30 days when tissue culture medium was used as the cold storage solution (18,19). Low dose penicillin (25 units/ml) with low dose streptomycin (25 µg/ml) was shown to be an effective antibiotic combination for skin graft storage (20). Grafts should be left free-floating in solution (21).

REFERENCES

1. Miller, TA: Charles procedure for lymphedema: A warning. *Am. J. Surg.* 139 (1980), 290.
2. Mavili, ME, S Naldoken, T Safak: Modified Charles operation for primary fibrosclerotic lymphedema. *Lymphology* 27 (1994), 14.

3. McIndoe, A: Discussion on the treatment of chronic oedema of the leg. *Proc. Royal Soc. Med.* 43 (1950), 1043.
4. Charles, RH: "Elephantiasis Scroti." In: *A System of Treatment*, Latham, AC, TC English (Eds.), Vol. III, J & A Churchill Ltd., London (1912), p. 504.
5. McKee, DM, MT Edgerton: The surgical treatment of lymphedema of the lower extremities. *Plast. Reconstr. Surg.* 23 (1959), 480.
6. Edgerton, MT: Colloquium: Lymphedema of the extremity. *Ann. Plast. Surg.* 1 (1978), 188.
7. Macey, HB: A new surgical procedure for lymphedema of extremities: Report of a case. *Proc. Staff Meet. Mayo Clin.* 15 (1940), 49.
8. Poth, EJ, SR Barnes, GT Ross: A new operative treatment for elephantiasis. *Surg. Gyn. Obstet.* 84 (1947), 642.
9. Pratt, GH: Surgical correction of lymphedema. *J. Am. Med. Assoc.* 151 (1953), 888.
10. Gibson, T, JS Tough: A simplified one-stage operation for the correction of lymphedema of the leg. *Arch. Surg.* 71 (1955), 809.
11. Dellon, AL, JE Hoopes: The Charles procedure for primary lymphedema: Long-term clinical results. *Plast. Reconstr. Surg.* 60 (1977), 589.
12. Rudolph, R, DL Ballantyne: Skin grafts. In: *Plastic Surgery*, McCarthy, JG (Ed.), Saunders, Philadelphia (1990), p. 259.
13. Calnan, J, FL Innes: Exposed delayed primary skin grafts: A clinical investigation. *Br. J. Plast. Surg.* 10 (1957), 11.
14. Lehman, JA, N Saddawi: Delayed open skin grafting. *Br. J. Plast. Surg.* 28 (1975), 46.
15. Smahel, J: Free skin transplantation on a prepared bed. *Br. J. Plast. Surg.* 24 (1971), 129.
16. Carrel, A: The preservation of tissues and its applications in surgery. *J. Am. Med. Assoc.* 59 (1912), 523.
17. Webster, JP: Refrigerated skin grafts. *Ann. Surg.* 120 (1944), 431.
18. Hurst, LN, DH Brown, KA Murray: Prolonged life and improved quality for stored skin grafts. *Plast. Reconstr. Surg.* 73 (1980), 105.
19. Rosenquist, MD, AE Cram, GP Kealey: Skin preservation at 4°C: A species comparison. *Cryobiology* 25 (1988), 31.
20. Cram, AE, MA Domayer: Short-term preservation of human autografts. *J. Trauma* 23 (1983), 872.
21. Rosenquist, MD, AE Cram, GP Kealey: Short-term skin preservation at 4°C: Skin storage configuration and tissue-to-volume medium ratio. *J. Burn Care Rehabil.* 9 (1988), 52.

Dr. Gregory Dumanian
3900 N. Charles Street #902
Baltimore, MD 21218 USA