

Latissimus dorsi free tissue transfer for coverage of extensive soft tissue defects

Alexandros E Beris, Panayotis N Soucacos, Theodore A Xenakis, Sakis Zaravelas, Gregory Mitsionis and Zoe Dailiana

15 latissimus dorsi free flap transfers were performed at the University of Ioannina Medical School during a 3-year period. Soft tissue defects in the upper (3) and lower (12) extremities resulting from trauma, septic pseudoarthrosis, osteomyelitis, open type IIIb fractures, incomplete amputations and tumor or unstable scar resection were covered by

myocutaneous flaps in 6 cases and muscle flaps with split thickness skin grafts in 9 cases.

Complications included pressure ulcer, infection hematoma and massive lung embolism. The results of the present study in which 13 of the 15 flaps were successful, suggest that an "orthoplastic" approach in covering soft tissue defects is beneficial.

Department of Orthopaedic Surgery, University of Ioannina, School of Medicine, Ioannina, Greece.
Correspondence: Alexandros E. Beris, M.D. Tel +30-651-45 731. Fax +30-651-46 222

With the advent of free tissue transfer in the field of microsurgery and the development of free flaps, orthopedic microsurgeons have gained the ability to manage a variety of extensive soft tissue defects resulting from major trauma, open fractures, osteomyelitis, or resection of tumors or unstable scars (Francel et al. 1992, Ruttle et al. 1984, Weiland et al. 1984). Various flaps have been devised for soft tissue coverage, including myocutaneous, fasciocutaneous and free muscle flaps. Under most circumstances of large soft tissue defects, there also exists severe bone defects as well, such as in trauma, osteomyelitis, etc. The successful management of most of these soft tissue injuries, therefore also entails rigorous treatment of the underlying bony defect by the orthopedist. In this regard, the successful application of these flaps in the treatment of soft tissue and underlying osseous tissue defects, involves the convergence of techniques used by the orthopedic, as well as the plastic surgeon. Thus, the array of problems encountered and techniques needed to treat severe tissue defects, ideally requires either a team consisting of both specialties or team members who have been fully trained in both fields, the so-called "orthoplasts" (Levin 1993).

Although the forearm flap has been one of the most frequently used flaps, its use has progressively diminished in favor of the latissimus dorsi myocutaneous or muscle flap. The shift is widely due to the significant advantages that it offers over relatively few drawbacks. The present report describes the results of

latissimus dorsi free flap transfers done at the Department of Orthopaedic Surgery, University of Ioannina Medical School over a 3-year period.

Patients and methods

During the period from 1991 to 1994, 14 patients, mean age 29 (5-64) years, with large soft-tissue defects underwent latissimus dorsi free flap transfer (15 free flaps). 11 were men and 3 were women (Table 1).

Operative management

Procedures were done under general anesthesia and tourniquet control with 2 teams operating, one at the donor site and the other at the recipient site. The patient was usually placed laterally with arm abducted and held in elevation. With a small rotation of the pelvis preparation of the ipsilateral lower extremity could be accommodated. For upper extremity reconstruction, usually the contralateral latissimus dorsi was used. The recipient site was prepared for free flap transfer by removing necrotic or infected tissue which may not be viable. The recipient vessels were isolated, but left intact. In the lower extremity, the most frequent recipient vessels were the posterior and anterior tibial arteries. The flap was harvested according to the method of Godina (1987) and Straus and Liang-Yu (1993). Except in special cases where a myocutaneous flap was needed, such as in cases with

| Case | Gender | Age | Etiology | Interval (days) | Type of flap | Flap size (cm) | Flap location |
|----------------|--------|-----|---------------------------|-----------------|---------------------|----------------|----------------------|
| 1 | M | 5 | Crush injury | 14 | Myocutaneous | 10x6 | Foot-plantar surface |
| 2 | M | 12 | Incomplete viable amp. | 13 | Muscle ^a | 16x10 | Foot-dorsum |
| 3 | M | 18 | Open IIIb fracture | 44 | Muscle | 10x8 | Tibia-middle third |
| 4 | F | 25 | Incomplete nonviable amp. | 10 | Myocutaneous | 12x8 | Humerus-distal third |
| 5 | M | 29 | Crush injury | 0 | Myocutaneous | 15x10 | Humerus-middle third |
| 6 | M | 36 | Septic pseudoarthrosis | 150 | Myocutaneous | 12x9 | Tibia-distal third |
| 7 ^b | M | 36 | Septic pseudoarthrosis | 240 | Myocutaneous | 13x10 | Tibia-distal third |
| 8 | M | 33 | Osteomyelitis | 206 | Muscle | 10x8 | Maleolus-middle |
| 9 | M | 38 | Osteomyelitis | 150 | Muscle | 8x6 | Tibia-proximal third |
| 10 | M | 64 | Crush injury | 3 | Muscle ^a | 20x10 | Foot-plantar surface |
| 11 | M | 35 | Unstable scar | 235 | Muscle | 10x10 | Tibia-middle third |
| 12 | F | 57 | Melanoma | 0 | Muscle | 15x13 | Foot-plantar surface |
| 13 | M | 14 | Crush injury | 30 | Muscle ^a | 14x8 | Forearm |
| 14 | M | 18 | Crush injury | 25 | Myocutaneous | 10x7 | Foot-plantar surface |
| 15 | F | 21 | Crush injury | 8 | Muscle | 15x10 | Ankle |

^a Muscle flap with small cutaneous island.
^b The same patient as the previous case.

skin loss on the plantar surface of the foot, only a muscle flap with a small skin monitor was used. Muscle flaps were covered with a split thickness skin graft.

14 patients were followed for an average of 22 (2–42) months after free flap transfers. Indications for latissimus dorsi flap included crush injury (6), septic pseudoarthrosis (1), osteomyelitis (2), tumor or unstable scar resection (2), open IIIb fracture (1), and incomplete viable or nonviable amputations (2). The mean period between the initial injury and the free flap transfer was 75 (0–240) days. 3 flaps were used for defects in the upper extremity, including the forearm in 2 cases and the lower third of the humerus in 1 case. 10 flap transfers were performed in the lower extremity, including weight bearing surface of the foot (4 cases). There were 6 myocutaneous flaps, and 9 muscle flaps with split thickness skin graft.

13 of the 15 latissimus dorsi flaps had successful results, 11 of which were excellent. Two flaps, one

muscle and one myocutaneous flap underwent necrosis, due to thrombosis at the site of arterial anastomosis. One patient underwent two free flap transfers, the second after the first flap failed. All other complications encountered were successfully managed (Table 2).

Discussion

Free flaps constitute the most common form of free-tissue transfer used in microsurgery today. Free flap transfer can be used as an emergency reconstruction or as a secondary procedure to cover soft tissue defects in both the upper and lower extremities. The latissimus dorsi has been making a solid place in the microsurgeon's armamentarium and its advantages are multiple: it is a large and versatile flap that can be tailored to meet the needs accurately. Donor site morbidity is minimal even after the entire muscle is removed, particularly if the skin is left intact (Colen et al. 1986). If the motor nerve is sutured, these flaps can include a functional muscle.

Over a 3-year period, 15 latissimus dorsi free tissue transfers were performed in our Clinic of which only 2 cases failed. This is an acceptable success rate which ranges in the literature from 80 to 95 percent (Clarke and Sherman 1993, Wood et al. 1985). Moreover, both failures occurred during our first year of using the latissimus dorsi as a free flap and after the initial learning curve of the first year, we have had no other failures. Although in both of these early cases which failed we had checked the sites of anastomosis, no attempt at revision was made due to the

| | |
|-----------------------|---|
| <i>Flap</i> | |
| Pressure ulcer | 1 |
| Infection | 1 |
| <i>Donor site</i> | |
| Hematoma | 2 |
| <i>General</i> | |
| Massive lung embolism | 1 |



Figure 1. Postero-lateral aspect (left) and medial aspect (right) of the left ankle and foot showing a severe crush injury (case no 15) caused in a motor vehicle accident. Note that the wound is circular with loss of soft tissue around the ankle area.



Figure 2. Anterior aspect (left) and medial aspect (right) showing excellent healing 2 years post-operatively. A latissimus dorsi muscle flap with a split thickness skin graft was used to cover the defect. The skin monitor can be seen in the medial aspect as shown by the arrow.

extended time of ischemia.

The latissimus dorsi can be used as a myocutaneous or muscle flap. However, it appears that the need for using both skin and muscle is now diminishing because of the superior cosmetic results achieved with split thickness skin grafts. Even specialized areas such as the plantar surface of the foot can have excellent results with a muscle flap and split thickness skin graft (Harris et al. 1994; Figures 1 and 2). Furthermore, by leaving the skin of the latissimus dorsi intact, donor site morbidity is minimal. On the other hand, a piece of skin can be lifted with the muscle flap to serve as a monitor for the detection of early vascular problems. Thermal probes are also helpful in this regard.

The results suggest that the use of a muscle flap in areas of both the upper and lower extremities which are compromised due to severe trauma or osteomyelitis is effective (Weiland et al. 1984). The beneficial results appear to be the result of covering these defects with healthy tissue which has a large blood supply.

References

- Clarke N, Sherman R. Soft-tissue reconstruction of the foot and ankle. *Orthop Clin N Am* 1993; 24(3): 489-503.
- Colen S R, Shaw W W, McCarthy JG. Review of the morbidity of 300 free-flap donor sites. *Plast Reconstr Surg*

- 1986; 77(6): 948-953.
- Francel T J, Vander Kolk G A, Hoopes J E, Manson P N, Yaremchuk M J. Microvascular soft-tissue transplantation for reconstruction of acute open tibial fractures: timing of coverage and long-term functional results. *Plast Reconstr Surg* 1992; 89(3): 478-487.
- Godina M. The tailored latissimus dorsi flap. *Plast Reconstr Surg* 1987; 80(2): 304-306.
- Harris P G, Letrosne E, Caouette-Laberge L, Egerszegi E P. Long-term follow-up of coverage of weight bearing surface of the foot with free muscular flap in a pediatric population. *Microsurgery* 1994; 15: 424-429.
- Levin L S. The reconstructive ladder: An orthoplastic approach. *Orthop Clin N Am* 1993; 24(3): 393-409.
- Ruttle P E, Kelly P J, Arnold P G, Irons G B, Fitzgerald Jr R H. Chronic osteomyelitis treated with a muscle flap. *Orth Clin N Am* 1984; 15(3): 451-459.
- Strauss B, Liang-Yu H. Atlas of microvascular surgery. Thieme Verlag, New York 1993: 482-503.
- Weiland A J, Moore J R, Daniel R K. The efficacy of free tissue transfer in the treatment of osteomyelitis. *J Bone Joint Surg* 1984; 66A (2): 181-193.
- Wood MB, Cooney WP, Irons GB. Lower extremity salvage and reconstruction by free tissue transfer. *Clin Orthop* 1985; 201: 151-161.