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## Case Report

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# Aesthetic Reconstruction of Tikhoff-Linberg Shoulder Defects with a Dual-Pedicle TRAM Free Flap

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Major defects of the shoulder are caused by trauma, radiation, infection, and tumors.<sup>1-6</sup> Functional limitation of the limb is considerable when the defect is large and has both skeletal and soft-tissue components. The contour deformity of large composite defects is a major aesthetic problem and causes difficulty with clothing. Treatment of this contour problem, as caused by ablative procedures for proximal humerus tumors, is examined in this report.

The Tikhoff-Linberg procedure is indicated for bone and soft-tissue sarcomas of the proximal upper limb that do not involve the nearby neurovascular structures. Typically, resection includes the distal clavicle, proximal humerus, and part or all of the scapula, as well as adjacent muscles.<sup>7-9</sup> This procedure preserves forearm and hand function and is far less deforming than the alternative of forequarter amputation. A skeletal prosthesis is used to preserve limb length and stabilize the arm to the chest. Shoulder motion is severely limited. The contour defect is not addressed at the time of the resection. In some patients, the thin and widely undermined skin flaps may require a local myocutaneous flap to ensure uncomplicated healing of the wound.

Patients adjust remarkably well to the functional limitations this procedure imposes. However, the contour deformity causes additional problems that are difficult to compensate for. An external prosthesis is usually required to simulate normal shoulder contour and fit clothing properly. These devices are similar to mastectomy prostheses. They are often troublesome

and can cause embarrassment due to poor fit or sudden dislodgment. Like the defect itself, these devices serve as a constant reminder of the disease.

Considerable volume is required to restore normal three-dimensional shoulder shape in these patients. The use of silicone implants for this purpose has been described in previous reports.<sup>10-13</sup> The experience with breast reconstruction suggests that an autogenous tissue approach to this problem may offer advantages of

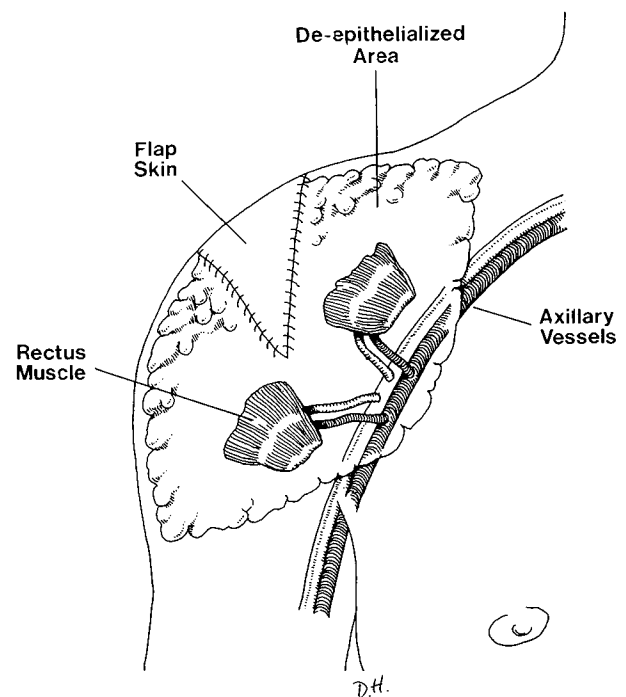


FIG. 1. Flap inset design.

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a more natural and durable reconstruction. The ideal flap must provide a large volume of tissue while causing minimal donor-site deformity. A transverse rectus abdominis musculocutaneous (TRAM) flap is a logical choice on the basis of these requirements.<sup>14</sup>

A pedicled TRAM flap does not have sufficient reach for this application. Free tissue transfer is therefore necessary, and a dual inferior epigastric pedicle is preferred in order to maximize the amount of usable flap tissue. The alternative of performing a preliminary delay procedure on one side has not proven to provide the same volume of tissue. An effective delay would require division of either both the superior and inferior deep epigastric supply or, as an alternative, all the muscular perforators and superficial epigastric artery on one side. This amounts to more than a minor additional procedure just to avoid one set of anastomoses. The subclavian vessels, their branches, and the external jugular vein are readily available as recipient vessels to facilitate a dual-pedicle free-flap approach. This report will demonstrate the feasibility and results

of this method of using a TRAM flap for reconstructing Tikhoff-Linberg shoulder defects.

#### PATIENTS AND METHODS

Two patients underwent TRAM free-flap reconstruction of their shoulder deformities. A small patch of rectus muscle was included with the skin island bilaterally. The flap was oriented parallel to the axis of the arm and shoulder. The two pedicles were anastomosed to adjacent sites on the recipient vessels (Fig. 1). The bulk of the flap was used to recreate the shoulder shape by simulating the deltoid muscle contour. The skin was deepithelialized, except for a segment in the middle which was interposed in the original suture line during wound closure. A small piece of Gore-Tex was used on each side to repair the anterior rectus sheath defect. This preserves abdominal wall integrity with a minimum of foreign material. It is usually not possible to close the rectus sheath defect securely without prosthetic material when both muscles are used. Secondary liposuction and skin excision were performed months later to finalize shoulder shape.

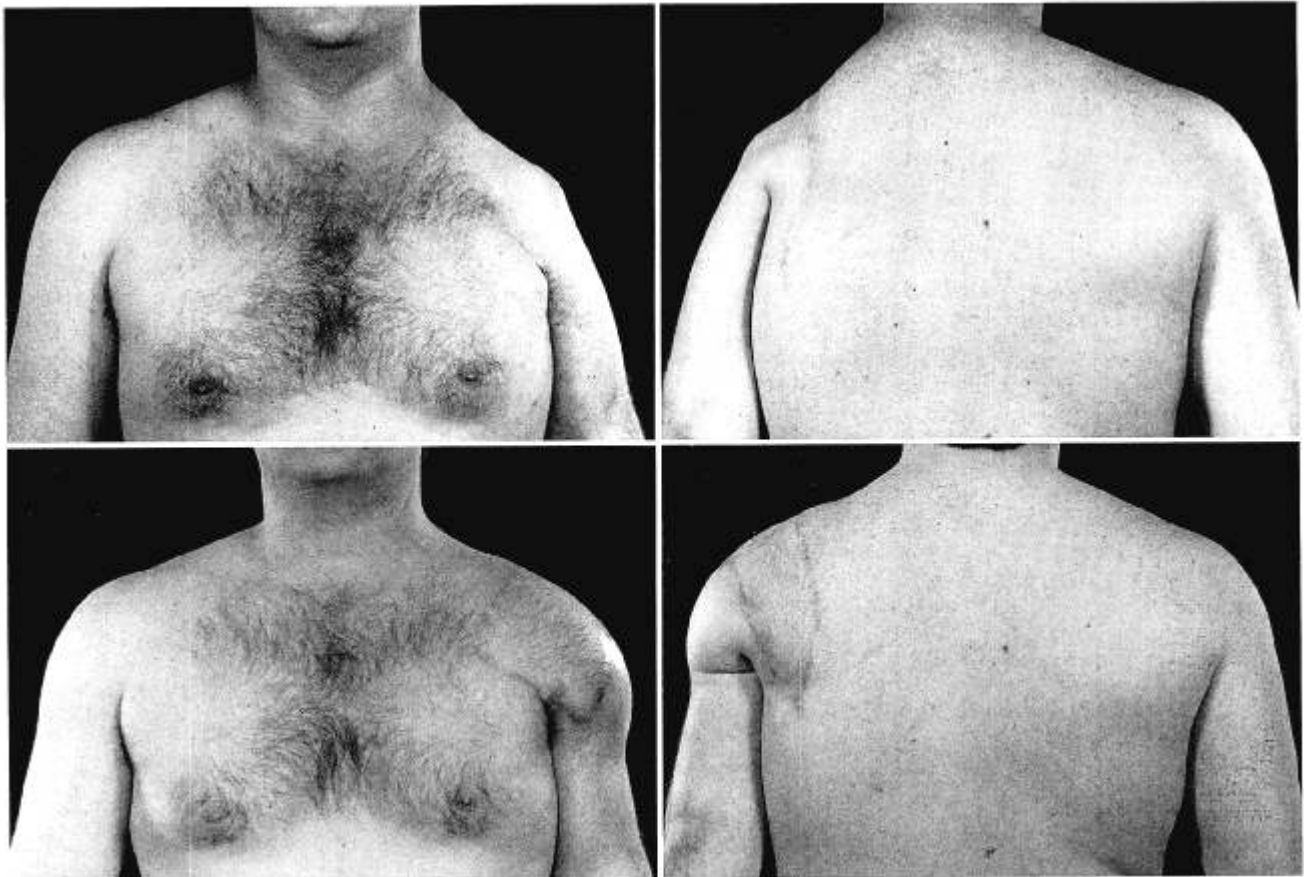


FIG. 2. Case 1. (Above, left and right) Preoperative anterior and posterior views of shoulder defect. (Below, left and right) Postoperative views 8 months after reconstruction.

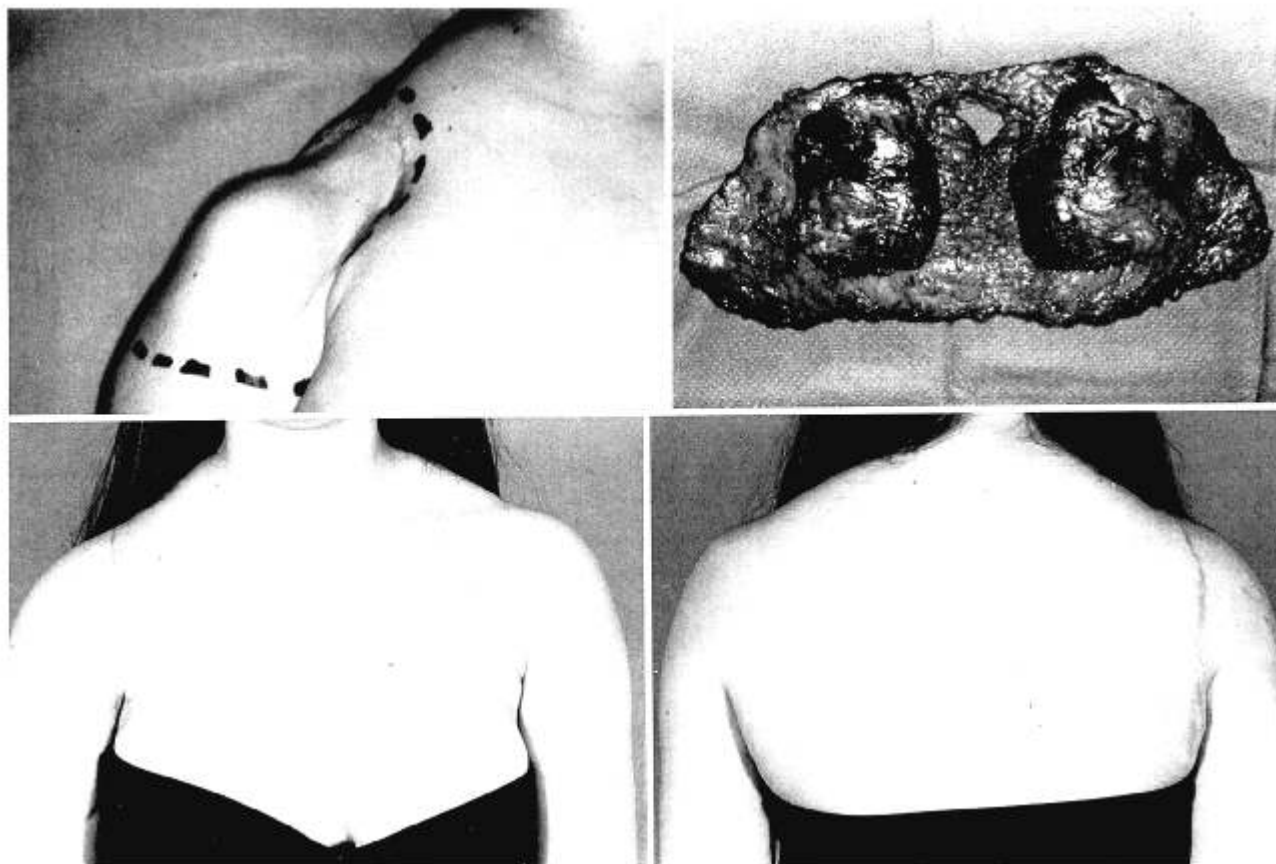


FIG. 3. Case 2. (Above, left) Preoperative view of the shoulder defect. (Above, right) TRAM flap undersurface shows both muscle pedicles. (Below, left and right) Postoperative views 7 months after reconstruction.

#### CASE REPORTS

##### Case 1

A 30-year-old man was treated initially with radiation therapy and chemotherapy 14 years ago for Ewing's sarcoma of the proximal humerus. Three years ago, a Tikhoff-Linberg resection was performed for biopsy-proven recurrence. Secondary reconstruction of the soft-tissue contour defect was accomplished with a dual-pedicle TRAM free flap. Microvascular arterial anastomoses were both performed to the axillary artery. The venous anastomosis of one pedicle was performed to the axillary vein and the other to the external jugular vein. The operative time was 12 hours. Seven months later the flap was revised by partial skin excision and liposuction. The patient is now 2 years postreconstruction without evidence of disease (Fig. 2).

##### Case 2

A 20-year-old woman underwent a Tikhoff-Linberg resection for an osteogenic sarcoma of the right proximal humerus. The skeletal prosthesis was changed 3 years later for mechanical reasons. The patient was free of disease for 6 years when she requested reconstruction of her shoulder deformity. A dual-pedicle TRAM free flap was utilized. Anastomoses were performed to the subclavian artery, proximal brachial artery, and subclavian vein. The operative time was 9 hours. Her postoperative course was unremarkable, and flap revision was performed 5 months later (Fig. 3).

#### RESULTS

Both flaps survived completely. Although it was obviously not possible to monitor each pedicle independently, there was no skin or fat necrosis in either flap to suggest thrombosis of one of the pedicles.

Restoration of contour in each patient was excellent (see Figs. 2 and 3). Neither has had to continue to wear a prosthesis. Shoulder function, as expected, was unchanged by the reconstruction. There was no donor-site morbidity.

#### DISCUSSION

The majority of reports describing flap reconstruction of shoulder defects have been for more limited soft-tissue problems. Local muscle flaps of modest bulk such as the pectoralis or latissimus dorsi have proven adequate to solve both the immediate wound problem and the limited contour deformity that characterize these defects.<sup>1-6,15-18</sup> These flaps are not useful for reconstruction of the Tikhoff-Linberg deformity. These defects have much greater soft-tissue re-

quirements, and the pedicles to the various local flaps may have been sacrificed during the course of resection.

Reconstruction with tissue expansion and silicone implants has been described previously to address the Tikhoff-Linberg deformity.<sup>10-13</sup> Shoulder contour has been improved with this method, but there are several disadvantages. Patients have experienced symptoms due to brachial plexus compression which have led to removal of the implant. Proper correction of contour may require more than one implant and more than one course of tissue expansion. Problems with capsular contracture can occur and require additional surgery. Implant reconstruction is not recommended for radiated shoulder defects. Implants are a reasonable alternative for those who are good candidates for reconstruction but lack a suitable TRAM flap donor site.

Reconstruction of Tikhoff-Linberg deformities should be performed as a delayed procedure for several reasons. The ablative procedure is lengthy and is usually attended by significant blood loss. It is not advisable to add a major microsurgical procedure to this, particularly when there is no immediate need for additional soft tissue to close the wound. It is also best to delay reconstruction until the prognosis has been more clearly defined by the passage of time. Patients are more willing to accept the risks associated with free-flap reconstruction if they have lived with the defect for awhile.

A dual-pedicle TRAM free flap will effectively reconstruct the Tikhoff-Linberg shoulder deformity in one step. A minor outpatient revision is usually performed later for additional improvement. The use of autogenous tissue provides a durable reconstruction without the disadvantages of implants. Young patients proven free of disease and having a suitable donor site are the best candidates. Although this entails a lengthy procedure that requires microsurgical skills, the results justify the effort.

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#### REFERENCES

- Rosenberg, L., and Mahler, D. Extended rotation-transposition of the pectoralis major myocutaneous flap in the repair of lesions over the shoulder. *Br. J. Plast. Surg.* 34: 322, 1981.
- Cohen, B. E. Shoulder defect correction with the island latissimus dorsi flap. *Plast. Reconstr. Surg.* 74: 650, 1984.
- Dowden, R. V., and McCraw, J. B. Muscle flap reconstruction of shoulder defects. *J. Hand Surg.* 5: 382, 1980.
- Stevenson, T. R., Randall, J., and Duus, E. C. Shoulder reconstruction following disarticulation for ruptured mycotic aneurysm. *Plast. Reconstr. Surg.* 74: 423, 1984.
- Mendelson, B. C., and Masson, J. K. Treatment of chronic radiation injury over the shoulder with a latissimus dorsi myocutaneous flap. *Plast. Reconstr. Surg.* 60: 681, 1977.
- Silverton, J. S., Nahai, F., and Jurkiewicz, M. J. The latissimus dorsi myocutaneous flap to replace a defect on the upper arm. *Br. J. Plast. Surg.* 31: 29, 1978.
- Marcove, R. C., Lewis, M. M., and Huvos, A. G. En bloc upper humeral interscapulothoracic resection: The Tikhoff-Linberg procedure. *Clin. Orthop.* 124: 219, 1977.
- Malawer, M. M., Sugarbaker, P. H., Lampert, M., Baker, A. R., and Gerber, N. L. The Tikhoff-Linberg procedure: Report of ten patients and presentation of a modified technique for tumors of the proximal humerus. *Surgery* 97: 518, 1985.
- Craig, D. M., Sullivan, P. K., Herdon, J. H., and Edstrom, L. E. One-stage arm-preserving shoulder resection with latissimus dorsi flap for basal cell carcinoma. *Ann. Plast. Surg.* 20: 158, 1988.
- Mendelson, B. C., and Masson, J. K. Silicone implants for contour deformities of the trunk. *Plast. Reconstr. Surg.* 59: 538, 1977.
- Mackinnon, S. E., and Gruss, J. S. Soft tissue expanders in upper limb surgery. *J. Hand Surg.* 10: 749, 1985.
- Menick, F. J., and Brody, G. S. Shoulder contour deformity after the Tikhoff-Linberg procedure: Correction by silicone implant. *Plast. Reconstr. Surg.* 66: 760, 1980.
- Dowden, R. V., Marks, K. E., and Stulberg, B. N. Expandable breast implant reconstruction of Tikhoff-Linberg shoulder deformity. *Plast. Reconstr. Surg.* 85: 112, 1990.
- Shaw, W. W., and Hidalgo, D. A. *Microsurgery in Trauma*. Mount Kisco, N.Y.: Futura, 1987. Pp. 293-301.
- Stern, P. J., and Carey, J. P. The latissimus dorsi flap for reconstruction of the brachium and shoulder. *J. Bone Joint Surg.* 70: 526, 1988.
- Abu-Jamra, F. N., Akel, S. R., and Shamma, A. R. Repair of major defect of the upper extremity with a latissimus dorsi myocutaneous flap: A case report. *Br. J. Plast. Surg.* 34: 121, 1981.
- Kim, P. S., and Lewis, V. L., Jr. Use of a pedicled parascapular flap for anterior shoulder and arm reconstruction. *Plast. Reconstr. Surg.* 76: 942, 1985.
- Palmer, R. S., and Miller, T. A. Anterior shoulder reconstruction with pectoralis minor muscle flap. *Plast. Reconstr. Surg.* 81: 437, 1988.