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ORIGINAL STUDY

Bipolar latissimus dorsi flap transfer for reconstruction of the deltoid

Luc De Smet

From the University Hospital Pellenberg, Leuven, Belgium

Four patients with complete paralysis of the deltoid muscle with irrepairable axillary nerve lesion and one with traumatic destruction of the shoulder cap were treated with a bipolar latissimus dorsi muscle transfer. The latissimus dorsi muscle was prepared as an island flap, turned over and sutured to the trapezius proximally and to the original deltoid insertion on the humerus distally. Function and cosmesis were excellent in two patients ; in one case the goal was only to achieve soft-tissue coverage, and was successfully achieved. One patient only had partial survival of the muscle and in one case the procedure failed to restore active functional abduction.

Keywords : deltoid reconstruction ; latissimus dorsi transfer.

INTRODUCTION

Loss of active abduction and anterior elevation (flexion) at the shoulder is a severe disability in daily life and professional activity, especially when the rest of the arm is normal and the active part – the hand – cannot be moved into space to exercise its function. Complete loss of active abduction is due to a combined deltoid and rotator cuff deficiency. The arm is flail, hanging along the trunk. The condition is often painful due to gravitational inferior subluxation of the glenohumeral joint and strain on the muscles. For such cases, most textbooks recommend shoulder arthrodesis with active scapulothoracic compensation of glenohumeral joint function.

Various tendon transfers have also been described to restore deltoid function, the most popular being transfer of the trapezius with part of the acromion to the humerus (*4,6*). However results are not better than after an arthrodesis. The scar is very conspicuous and the visual appearance of the shoulder is not restored. This is an important concern in young patients.

In 1987 Itoh *et al* (*5*) described transfer of latissimus dorsi to replace the paralysed anterior deltoid. We report 5 cases treated following their technique.

MATERIAL AND METHODS

Patients

From 2002 to 2007 the operation was performed on five patients, four men and one woman (table I). Four patients had a flail shoulder secondary to a partial brachial plexus injury ; the goal in these four patients

■ Luc De Smet, Orthopaedic Surgeon, Head of division of Hand Surgery.

Department of Orthopaedic Surgery, U.Z. Pellenberg, Lubbeek, Belgium.

Correspondence : Luc De Smet , Department of Orthopaedic Surgery, U.Z. Pellenberg, Weligerveld 1, 3212 Lubbeek (Pellenberg), Belgium. E-mail : luc.desmet@uz.kuleuven.ac.be

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Table I. — Summarised data of patients with grade in Gilbert's scale

Patient	Age (years)	Clinical situation	Preop.	Postop.
1	M 38, Le	High velocity gunshot wound, destroyed shoulder joint ; plexus posterior cord. LD transfer only for coverage.	NA	NA
2	M 27, Le	MVA, Scapular fracture, partial plexus palsy, axillary nerve explored but not repairable.	2	5
3	M 38, Ri	MVA, Upper plexus 6 years delay, delayed wound healing, frozen shoulder, failure	1	1
4	M 34, Le	MVA, Partial upper plexus (1 year delay) no recovery axillary & Suprascapular nerve, delayed wound healing, partial LD muscle necrosis	1	5
5	F 52, Ri	RC rupture + axillary nerve lesion post manipulation without recovery (18 months delay), delayed wound healing	2	5

(LD : latissimus dorsi ; MVA : motor vehicle accident ; RC : rotator cuff ; NA : not applicable).

was to restore active shoulder abduction. One patient had a destroyed shoulder cap as a result of a high velocity shot wound, and the latissimus dorsi flap was proposed to reconstruct the soft tissues in order to proceed to an arthroplasty later on.

Operative technique

The patient was placed in the lateral decubitus. The latissimus dorsi muscle was dissected through an incision extending distally from the axilla along the anterior border of the muscle. The muscle was freed and its neurovascular pedicle was protected. The humeral insertion and the costal origin of the muscle were divided. The muscle was then an island flap only attached with its neurovascular bundle. The muscle once freed was turned 180°, inverted and passed anterior of the shoulder, deep to the pectoralis major muscle. The deep aspect of the muscle thus became superficial. The transposed muscle was sutured back into place : its costal origin to the trapezius and its humeral insertion to the tendon of the deltoid (for both sutures, a separate incision was required and subcutaneous tunnels were made between the incisions). The shoulder was immobilised in an abduction splint for 6 weeks, following which gentle mobilisation was started.

Evaluation

The Gilbert scale was used to classify the shoulder paralysis (table II) *(4)*.

Table II. — Classification of Shoulder Paralysis (Gilbert & Raimondi)

	Abduction	External rotation
0	flail	flail
1	45° abduction	no active ext. rotation
2	< 90°	no active ext. rotation
3	90°	weak
4	< 120°	incomplete
5	> 120°	active ext. rotation
6	normal	normal

RESULTS

An excellent functional outcome was achieved in three patients, with full recovery of active abduction. In one patient the goal was to restore a good soft-tissue coverage to allow for subsequent shoulder arthroplasty. The patient however was pleased with the muscle transfer, his pain was relieved and he declined any further intervention. One transfer failed.

Complications

Delayed wound healing was observed in three patients. Healing was achieved with local wound care in two, a secondary debridement was necessary

Fig. 1. — (a) Preoperative condition ; active abduction was limited to 60°, (b) postoperative aspect and function (case 2)

and partial muscle necrosis was observed in the third patient. Despite this he obtained an excellent outcome.

DISCUSSION

Abduction of the shoulder is produced by the action of the deltoid and rotator cuff muscles. Loss of active abduction and anterior elevation is a disabling condition for active patients. Atrophy of the muscles also disturbs the contour of the shoulder, which appears to bother several (male) patients. Glenohumeral arthrodesis can still be indicated, especially when the elbow is also paralysed and the number of available donor muscles is low. Following arthrodesis, patients improve in 60% of cases *(2)* but the abduction range is poor : 48 to 60° *(8,10)*.

Tendon transfers to restore active abduction have mostly used the trapezius muscle. The technique was modified by Saha in 1967 *(6)*, and a recent paper by Kotwal *et al (6)* in 1998 reporting 26 patients, found a good result in 60% of them (power M4). The average gain in active abduction

Fig. 2. — Good contraction of the transferred latissimus dorsi (case 4).

Fig. 3. — Reconstruction of the soft tissues (a) preoperatively, (b) postoperatively (case 1).

was 60° in the brachial plexus group. The scar is very conspicuous and usually hypertrophic. The contour of the shoulder is not restored. Other papers by Ruhman *et al* (*10*) and Aziz *et al* (*1*) obtained an abduction of 36° and 45° respectively with this technique, which is not better than with a shoulder arthrodesis. The idea of using the latissimus dorsi was based on experience with the use of this muscle for other reconstructive goals (*8,9*). In 1982 Lai *et al* described coverage of the shoulder with a latissimus dorsi myocutaneous flap (*7*). Stern and Carey in 1988 (*12*) reported excellent and good results for the reconstruction of the shoulder and arm in 19 patients with the latissimus dorsi flap. None was done for a paralysed deltoid however.

Itoh *et al* (*5*) developed the technique and reported on 10 patients in 1987 : active flexion over 90° was achieved in 6 of them. All but one had M4-power and a good shoulder contour was present in all. A case report by Ferrier *et al* in 1995 (*3*) described a complex reconstruction of the shoulder with a similar flap and a hemiarthroplasty.

The high incidence of wound healing problems is of great concern. Technical refinement is necessary to avoid this. The turn over and rotation of the muscle flap and its passage under the pectoralis muscle and into a subcutaneous tunnel are all potentially dangerous maneuvers which can twist, kink or compress the vascular pedicle.

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