Trapezius transfer for shoulder paralysis

6 patients with brachial plexus injuries followed for 1 year

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We transferred the trapezius with its bone insertion to the proximal humerus in 6 patients for treatment of a paralytic shoulder secondary to traumatic lesions of the brachial plexus. After 1 year, the shoulder abduction was improved from average 13° (0°–30°) preoperatively to 76° (50°–100°) postoperatively, and the shoulder flexion from 18° (0°–40°) to 78° (45°–110°) postoperatively. All the patients were satisfied with the outcome.

We consider that transfer of the trapezius in a paralytic shoulder after brachial plexus injury gives a better outcome than shoulder fusion.

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Two types of reconstruction have been advocated to improve the function in posttraumatic paralysis of the shoulder: shoulder arthrodesis and tendon-muscular transfers.

Shoulder arthrodesis is preferred by many authors (Cofield and Briggs 1979, Vastamäki 1987, Richards et al. 1988, Chammas et al. 1996). However, arthrodesis permits only a limited range of abduction and includes a high incidence of complications, e.g., fractures (Cofield and Briggs 1979, Chammas et al. 1996) and pseudoarthrosis (Vastamäki 1987, Chammas et al. 1996).

Several muscle transfers have been tried to improve the movement of the flail shoulder. Most were initially described for treatment of paralysis after poliomyelitis (Mayer 1927, Harmon 1950, Saha 1967). In recent years, some authors have reported their good experience with trapezius muscle transfer for the paralytic shoulder after brachial plexus injuries (Karev 1986, Aziz et al. 1990, István et al. 1993).

We evaluated the usefulness of transfer of the trapezius muscle to the proximal humerus in 6 patients having brachial plexus injuries.

Patients and methods

During 1995–1996 we treated 6 patients having a posttraumatic paralysis of the shoulder muscles with a transfer of the trapezius distal insertion in the acromion and distal clavicle to the greater tuberosity of the humerus. The patients were followed mean 19 (12–25) months.

All patients were men and all had been involved in a motor-vehicle accident. The mean age was 28 (20–42) years. There were 4 right and 2 left shoulders. The average interval between the brachial plexus injury and the procedure was 31 (12–57) months. In all patients, surgery was delayed to exclude spontaneous recovery of the muscle's function, with an interval longer than 2 years from the injury or an attempt at surgical reconstruction of postganglionic lesions or an interval longer than 1 year in preganglionic lesions. In 2 patients, a reparative procedure of the brachial plexus had been attempted (neurolysis in one patient and nervous grafts in the other), without recovery of the shoulder abduction.

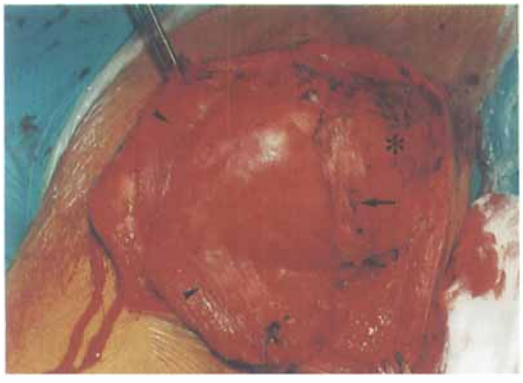
Our indications for trapezius transfer were irreversible absence of active abduction of the shoulder, passive abduction of the shoulder greater than 90° (in our patients the average passive abduction was 120° (95°–160°)), strong trapezius muscle (at least M4), functional movements of the elbow and the hand, and absence of substantial degenerative changes in the shoulder joint.

Preoperatively, the average abduction of the shoulder, measured as the angle between the lateral aspect of the trunk and the arm, was 13° (0°–30°) and the average flexion was 18° (0°–40°). 3 patients complained of mild pain and 3 patients had no pain.

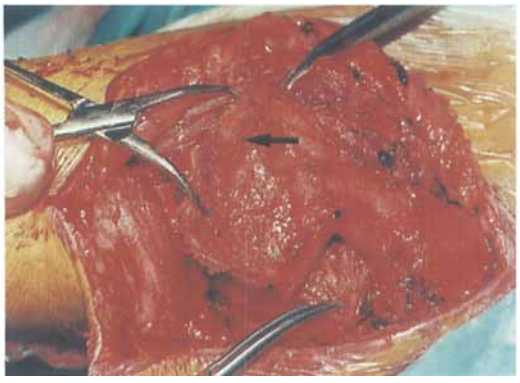
Surgical technique

We used a technique described by Saha (1967), which is based on the techniques reported by Mayer (1927) and Bateman (1955). The patient is placed in the supine, half-seated position.

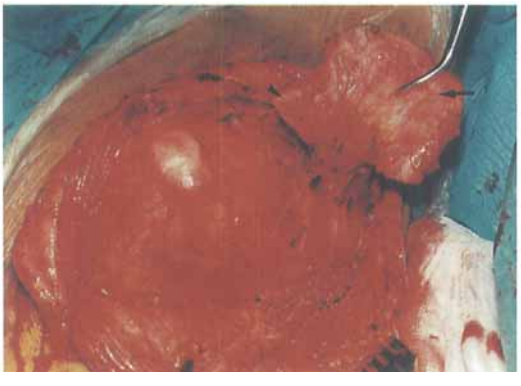
Figure 1. The operation.



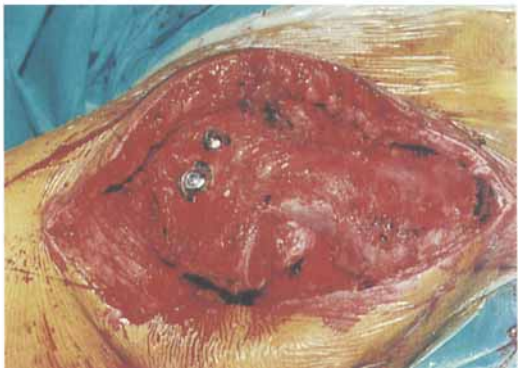
a. Longitudinal approach that exposes the trapezius muscle (asterisk), with its distal insertion in the acromion (arrow). The deltoid is opened longitudinally (arrowheads).



c. Transfer of the acromion (forceps) to the greater tuberosity of the humerus in a 90° abduction and 20° external rotation position.



b. Osteotomy of the acromion (arrow) and distal 1–2 cm of the clavicle (arrowhead).



d. Fixation of the acromion to the proximal humerus with two 6.5 mm cancellous screws.

Clinical data

A	B	C	D	E	F	G	H	I	J	K	L	M
1	21	M	Motorcycle	R	Nerve grafts (3 yr before)	43	6	25	30	80	20	90
2	29	M	Motorcycle	R	No	14	6	23	0	75	10	70
3	20	M	Motorcycle	R	No	22	6	18	20	50	20	45
4	42	M	Motorcycle	R	No	34	6	17	10	100	40	110
5	33	M	Car	L	Neurolysis (4 yr before)	57	7	17	0	80	0	70
6	22	M	Motorcycle	L	No	12	8	12	20	70	20	80

A Case
B Age
C Sex
D Mechanism
E Side
F Previous surgery
G Interval injury-surgery, mo
H Bone fusion time, wk
I Follow-up, mo
J Preoperative abduction
K Postoperative abduction
L Preoperative flexion
M Postoperative flexion

We used a 20-cm longitudinal skin incision, centered over the acromion (Figure 1). The insertion zone of the trapezius at the acromion and the distal aspect of the clavicle was identified. An osteotomy with an oscillating saw was made at the base of the acromion and through the clavicle, immediately lateral to the coraco-clavicular ligaments. The middle deltoid was longitudinally sectioned to expose the proximal humerus. The inferior part of the acromion and the lateral part of the proximal humerus were buried. In 90° of abduction and 20° external rotation, the acromion was fixed to the proximal humerus with two 6.5 mm cancellous screws. The deltoid was sutured over the transferred trapezius.

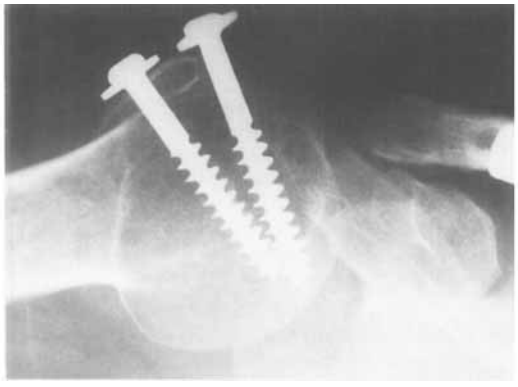


Figure 2. Case 1 at 1 year. Consolidation of the acromion with an active abduction of 80 degrees.

Figure 3. Case 4. Clinical appearance at 18 months: Abduction of 95 degrees.

Postoperatively, the shoulder was immobilized with an abduction splint at 90° during 6 weeks. After this, progressive adduction of the shoulder was allowed in the splint during 2–3 weeks and a rehabilitation program for 2 months was started.

Results

The average operation time was 95 (75–135) minutes and the mean blood loss was 250 (200–350) mL. The time until bone fusion was 6–8 weeks. There were no infections, pseudoarthroses or material failure.

The average abduction at the time of the follow-up was 76° (50°–100°) and the average flexion was 78° (45°–110°). All patients, except one, could lift 2 kg higher than 45° abduction. 5 patients had no shoulder pain at the follow-up, 1 patient had the same mild neuritic pain as preoperatively.

All patients were satisfied with the outcome (Figures 2–3).

Discussion

Most authors prefer shoulder arthrodesis for palliation of the posttraumatic flail shoulder (Rowe 1974, Beltran et al. 1975, Cofield and Briggs 1979, Richards et al. 1988). There are some disadvantages with arthrodesis: a limited range of abduction, frequently less than 60° (Vastamäki 1987), normal mobility of the scapulo-thoracic joint is a prerequisite and this is an irreversible procedure, not justified if any probability of recovery exists (for instance after intercostal nerves neurotization). Arthrodesis inhibits the passive mobility of the joint, making some daily activities like dressing (Cofield and Briggs 1979) or putting the hand in the pockets (Ducloyer et al. 1991) difficult.

Arthrodesis is associated with a high incidence (about one fifth) of complications, such as fractures (Cofield and Briggs 1979, Chammas et al. 1996) and pseudoarthrosis (Vastamäki 1987, Ducloyer et al. 1991). Pain in the shoulder region is common after arthrodesis (Neer and Hawkins 1977, Richards et al. 1985), and many patients are dissatisfied (Cofield and Briggs 1979, Chammas et al. 1996) and some feel worse than before surgery (Neer and Hawkins 1977).

Therefore, some authors consider that muscle transfers are better than shoulder arthrodesis (Harmon 1950, Makin 1977). The problem is that only a few muscles remain available after brachial plexus injuries: the levator scapulae, rhomboid and trapezius muscles remain functional in almost all cases (Narakas 1993).

Itoh et al. (1987) reported on latissimus dorsi transfer to replace the anterior deltoid, and obtained a postoperative flexion of the shoulder (101° on average) greater than ours. However, the abduction obtained with the latissimus dorsi transfer is less (37° on average) and the surgical technique seems more difficult, with a substantial danger of injure to the vascular bundle of the muscle and necrosis of the muscle (Narakas 1993). We think that trapezius transfer, in spite of the lesser lever arm, is better than latissimus dorsi transfer, because the movement is in the scapula plane, which provides more mobility and stability (Comtet and Herzberg 1989). Moreover, the latissimus dorsi innervation, through the thoracodorsal nerve, is usually deficient, because it is formed from C6, C7 and C8 roots.

In most patients with a brachial plexus injury, the trapezius muscle innervation (from the spinal accessory nerve, 11th cranial nerve) is not injured. Moreover, the trapezius muscle is frequently hypertrophied in patients with deltoid paralysis (Comtet and Herzberg 1989).

The surgical technique was initially described by Mayer (1927), who also used a fascia lata plasty to increase the length of the trapezius insertion. Bateman (1955) described the transfer with acromion osteotomy and other experiences were later published by several authors (Saha 1967, Karev 1986, Aziz et al. 1990, István 1993).

We have employed the modification described by Saha (1967), with two slight changes: the skin incision we have used is longitudinal, allowing an adequate exposure of all the surgical field, and it can be extended proximally to allow a more extensive release of the trapezius, if necessary. With 6.5 mm cancellous screws we achieved the necessary stabilization of the acromion to the humerus. Karev (1986) proposed the fixation should be done in 45° internal rotation. However, we attempted fixation in a slightly anterior position, because all our cases had an associated paralysis of the deltoid and supraspinatus, an anterior position that provides some external rotation (Saha 1967).

The trapezius muscle transfer can be combined with other palliative surgical procedures in the upper limb, such as medial epicondyle transfer to the anterior aspect of the humerus to restore elbow flexion (Alnot and Monod 1987) or wrist arthrodesis.

References

Alnot J Y, Monod A. Les paralysies C5-C6 et C5-C6-C7 du plexus brachial. Rev Chir Orthop (Suppl II) 1987; 73: 249-53.

Aziz W, Singer R M, Wolff T W. Transfer of the trapezius for flail shoulder after brachial plexus injury. J Bone Joint Surg (Br) 1990; 72: 701-4.

Bateman J E. The shoulder and environs. C V Mosby, St Louis 1955.

Beltran J E, Trilla J C, Barjau R. A simplified compression arthrodesis of the shoulder. J Bone Joint Surg (Am) 1975; 57: 538-41.

Chammas M, Meyer zu Reckendorf G, Allieu Y. L'arthrodèse d'épaule pour paralysie post-traumatique du plexus brachial. Rev Chir Orthop 1996; 82: 386-95.

Cofield R H, Briggs B T. Glenohumeral arthrodesis. Operative and long-term functional results. J. Bone Joint Surg (Am) 1979; 61: 668-77.

Comtet J J, Herzberg G. Biomechanical basis of transfers for shoulder paralysis. Hand Clin 1989; 5: 1-14.

Ducloyer P H, Nizard R, Sedel L. Arthrodèse d'épaule dans les paralysies du plexus brachial. Rev Chir Orthop 1991; 77: 396-405

Harmon P. Surgical reconstruction of the paralytic shoulder by multiple muscle transplantations. J Bone Joint Surg (Am) 1950; 32: 583-95.

István L, Gábor D, Ervin R. Nervus axillaris sérülést követöen kialakult delta izombénulás kezelése musculus trapezius trnaspositiójával. Magyar Traum Ort Kezs Plasz Seb 1993; 36: 87-92.

Itoh Y, Sasaki T, Ishiguro T, Uchinishi K, Yabe Y, Fukuda H. Transfer of latissimus dorsi to replace a paralysed anterior deltoid. J Bone Joint Surg (Br) 1987; 69: 647-51.

Karev A. Trapezius transfer for paralysis of the deltoid. J Hand Surg 1986; 11-B: 81-3.

Makin M. Early arthrodesis for a flail shoulder in young children. J Bone Joint Surg (Am) 1977; 59: 317-21.

Mayer L. Transplantation of the trapezius for paralysis of the abductors of the arm. J Bone Joint Surg 1927; 9: 412-20.

Narakas A O. Muscle transpositions in the shoulder and upper arm for sequelae of brachial plexus palsy. Clin Neurol Neurosurg 1993; 95: 89-91.

Neer C S, Hawkins R J. A functional analysis of shoulder fusions. J Bone Joint Surg (Br) 1977; 59: 508.

Richards R R, Waddell J P, Hudson A R. Shoulder arthrodesis for the treatment of brachial plexus palsy. Clin Orthop 1985; 198: 250-8.

Richards R R, Sherman R M P, Hudson A R, Waddell J P. Shoulder arthrodesis using a pelvic-reconstruction plate. A report of eleven cases. J Bone Joint Surg (Am) 1988; 70: 416-21.

Rowe C R. Re-evaluation of the position of the arm in arthrodesis of the shoulder in the adult. J Bone Joint Surg (Am) 1974; 56: 913-22.

Saha A K. Surgery of the paralysed and flail shoulder. Acta Orthop Scand (Suppl 97) 1967: 1-91.

Vastamäki M. Shoulder arthrodesis for paralysis and arthrosis. Acta Orthop Scand 1987; 58: 549-53.