

RESTORATION OF FLEXION IN A PARALYTIC ELBOW BY PECTORALIS MAJOR TRANSFER. LONG-TERM RESULT OF A CASE

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A 22 year-old male patient, suffered from residual paralysis of the left upper limb due to poliomyelitis. The shoulder was flail, and active flexion of the elbow was impossible. The patient was treated with transfer of part of the pectoralis major muscle to the biceps tendon and fusion of the ipsilateral shoulder. At the latest follow-up, 42 years postoperatively, the functional result is excellent with full active flexion of the elbow and ability to lift 5 kg of weight.

Keywords : elbow ; paralysis ; tendon transfer ; muscle transfer.

Mots-clés : coude ; paralysie ; transfert tendineux ; transfert musculaire.

INTRODUCTION

The difficulty or inability to actively flex the elbow was usually in the past a result of poliomyelitis, but nowadays it can be a result of either birth palsy or trauma to the brachial plexus. In cases where the function of the ipsilateral shoulder is limited or the shoulder is flail, compromised elbow flexion creates a more severe limitation for the patient.

Several techniques (1-4, 8), more or less complicated, have been described to restore active elbow flexion.

CASE REPORT

A 22-year-old Caucasian male was admitted to our department suffering from residual paralysis of the left upper limb due to poliomyelitis.

The left shoulder was flail, while active flexion of the ipsilateral elbow joint and rotational movements of the forearm were impossible.

The muscles of the shoulder region were completely paralyzed (except the serratus anterior muscle) as well as the biceps and brachialis muscles. The strength of the pectoralis major muscle as well as the function of the hand were normal. Radiographically the shoulder joint had a paralytic distal subluxation.

A pectoralis major transfer was performed in June 1957. With the patient supine, the arm in moderate abduction and the elbow in complete extension, an incision was made distally from the axillary fold along the lateral border of the pectoralis major to the seventh rib. An L-shaped incision was then made in the distal fourth of the arm, with the transverse incision in the flexor crease of the elbow and the longitudinal incision extending proximally along the lateral margin of the biceps muscle. The pectoralis major muscle was exposed and its lateral border and distal costal attachment were defined. The distal third (about 6 cm wide) was freed from the remainder of the muscle as well as the origin of this part of the muscle and was elevated with part of the sheath of the rectus abdominis to lengthen the transfer and to serve as a tendon for insertion. During mobilization of the transfer proximally, a major terminal branch of the lateral anterior thoracic nerve which appeared at the level of the third intercostal space was protected.

Next the distal biceps and its tendon were exposed through the arm incision. By blunt dis-

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section, a large tunnel was created beneath the deep fascia between the two incisions, and the transfer of the muscle to the arm was performed, taking care that the neurovascular bundle was not taut.

Then with the elbow flexed to 120° and the forearm in supination, the transferred muscle was sutured to the biceps tendon. A posterior plaster splint holding the elbow flexed to 120° was applied, and the arm was immobilized for 3 weeks against the side of the chest with a light Velpeau dressing.

Three weeks after the operation, the plaster and the stitches were removed, the sling was retained for another three weeks, the transplanted muscle was stimulated daily with electrical current, and re-education of the muscle was started.

Three months later the shoulder joint was fused through a Darrach-McLaughlin transacromial approach using a single screw.

At the latest follow-up, 42 years postoperatively, the patient had full active extension (fig. 1a) and 120° of active flexion at the elbow (fig. 1b) with grade 4 muscle strength, and he was able to lift 5 kg of weight (fig. 2). He was very satisfied with the final functional result as well as the cosmetic appearance.

DISCUSSION

The most commonly used operative techniques to restore elbow flexion after paralysis of the flexor muscles are :

Steindler's flexoplasty in which the common flexor origin is detached and reattached, approximately 5 cm proximal on the medial aspect of the humerus. This procedure is indicated when the biceps brachii and brachialis are paralyzed and the muscles arising from the medial epicondyle are fair or better in strength. The best results are obtained when the elbow flexors are only partially paralyzed.

The **latissimus dorsi transfer** : This operation is technically more difficult and results in extensive scarring (6).

Triceps to biceps transfer around the lateral aspect of the humerus to the radius was described

in detail by Carroll (3). In general (6), triceps transfer has produced a good result, especially in cases with co-contraction, but this transfer means that the patient loses active extension. Loss of active extension is such a disadvantage that it greatly restricts the indications for this operation (8).

Sternocleidomastoid transfer as described by Bunnel (2) is seldom used now because of the unacceptable scarring that can occur (6).

Pectoralis minor transplant described by Spira (8) was performed in only one patient in whom the pectoralis major muscle was found to be atrophied, with only a few fibers reacting to pinching.

Pectoralis major transfer : This technique, which was performed on our patient, has been described in detail by Clark (4). The first such operation, to our knowledge, was described in 1917 ; Schulze-Berge (7) transplanted the tendon of insertion of the pectoralis major directly into the belly of the biceps. Various modifications of this technique were later employed.

Brooks and Seddon (1) reported 10 patients in 6 of whom the result was excellent or good, while according to Marshall *et al.* (6) this technique was disappointing, and none of their four patients achieved a good result.

In contrast the result was excellent in our patient during this long-term follow-up. As far as breast asymmetry or scarring are concerned (fig. 1a), there was no problem. A prerequisite for this technique is normal strength of the pectoralis major muscle. A flail shoulder led to an unsatisfactory result, and for this reason shoulder fusion (fig. 3) was performed in our patient three months after the pectoralis major transfer.

If the shoulder can be stabilized, either by muscular control or by arthrodesis, the power of a pectoral transplant is greatly enhanced because it acts only on the elbow (1). For this reason Brooks and Seddon (1) suggest arthrodesis of the shoulder either before (in order to avoid a long and possibly harmful period of fixation of the elbow) or after the transplant.

In the patient described the shoulder fusion was performed after the pectoralis major transplant in order to see first the early result of the transfer

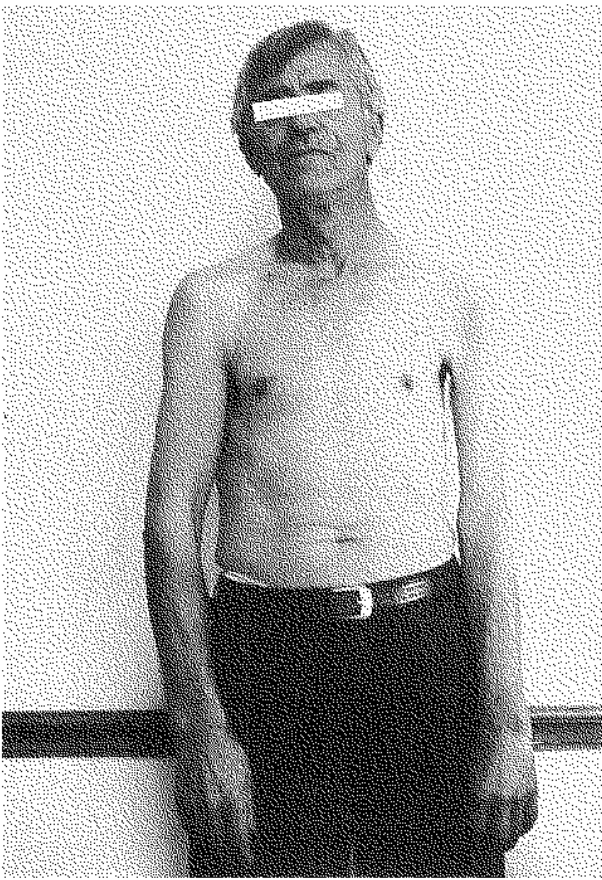
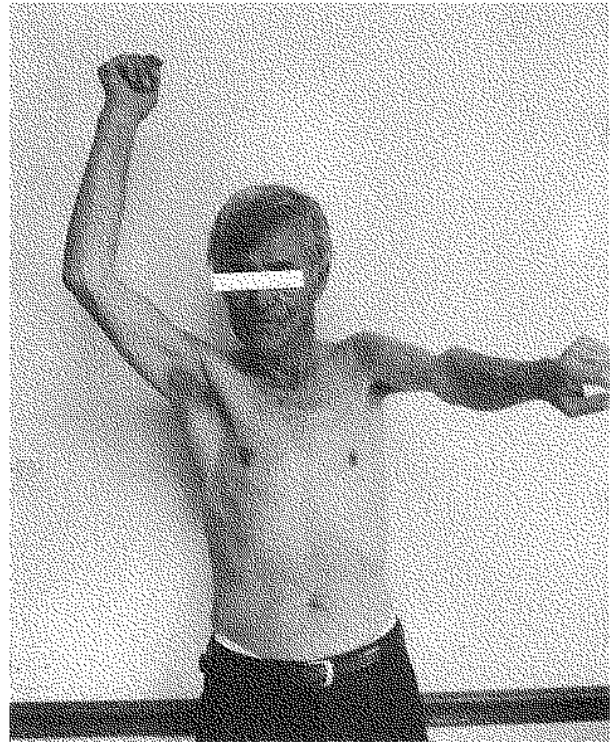
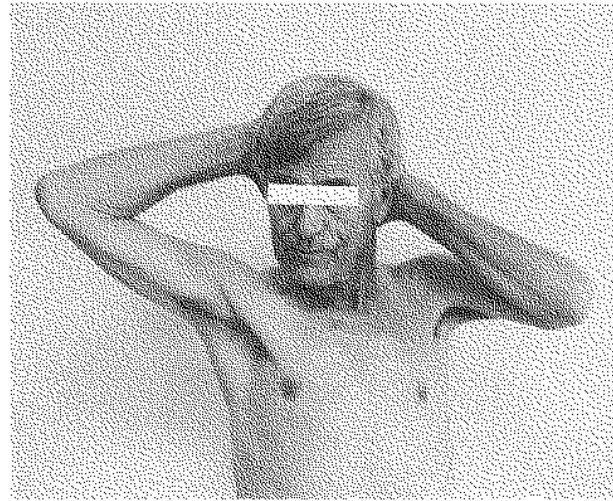
**a****c****b****d**

Fig. 1. — Active movements of the left elbow and the ipsilateral shoulder 42 years postoperatively. a) Extension and b) Flexion of the elbow c) Abduction of the shoulder and d) Ability to place the hand behind the neck.



Fig. 2. — Ability to lift a weight of 5 kg with the elbow actively flexed and the arm actively abducted.

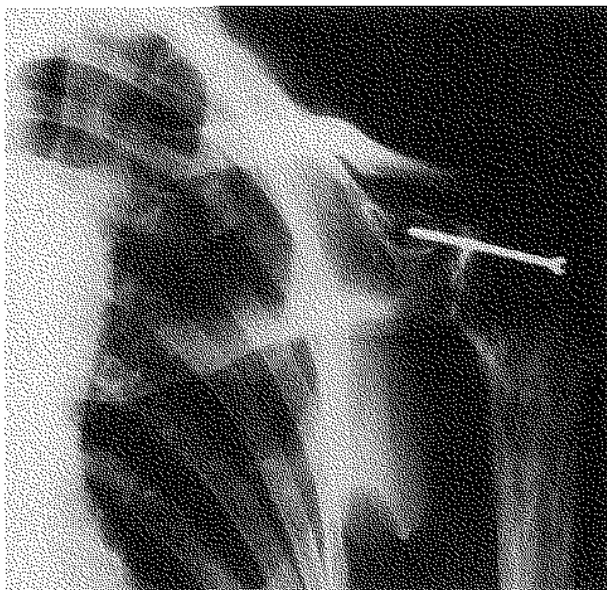


Fig. 3. — Radiographic appearance of the fused shoulder 42 years postoperatively.

and then whether it was necessary to stabilize the shoulder joint.

It must be emphasized that immediately after the operation active flexion of the elbow was accompanied by contraction of the undisturbed part of the pectoralis major, but after a period of three months independent flexion of the elbow was achieved.

The function of the shoulder and the entire left limb, according to the functional classification of Kirkos and Papadopoulos (5), was very satisfactory (fig. 1c, d).

The relatively minor Steindler flexoplasty is useful but this procedure cannot be employed in the presence of paralysis (or traumatic loss) of the common flexor mass arising from the medial epicondyle. In these cases Clark's procedure (4) promises, as in the patient described, a permanent and very satisfactory functional result, a prerequisite for which in all these cases, is a stable shoulder.

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SAMENVATTING

J. M. KIRKOS, J. H. HARITIDIS. Herstel van de elleboogflexie door transfer van de M. Pectoralis major.

De auteurs beschrijven een casus van een 22-jarige patiënt met residuele paralyse van het linker bovenste lidmaat door poliomyelitis.

De schouder was volledig atoon en de elleboogflexie was onmogelijk. De patiënt werd behandeld door transfer van een deel van de M. Pectoralis major op het caput longum van de M. Biceps (ingreep volgens Clark) en een schouderarthrodese.

Na 42 jaar was het functioneel resultaat uitstekend met een volledige elleboogflexie en de mogelijkheid om gewichten tot 5 kg op te tillen.

RÉSUMÉ

J. M. KIRKOS, J. H. HARITIDIS. Rétablissement de la flexion d'un coude paralytique par transfert du grand pectoral. A propos d'un cas suivi à long terme.

Les auteurs présentent le cas d'un patient âgé de 22 ans atteint d'une paralysie résiduelle du membre supérieur gauche due à la poliomyélite.

L'épaule était ballante et la flexion active du coude, impossible. Le patient a été traité par le transfert d'une partie du grand pectoral sur le tendon du long biceps (opération de Clark) et arthrodèse de l'épaule du même côté.

Quarante-deux ans après l'intervention, le résultat fonctionnel est excellent. Le patient présente une flexion active complète du coude et il est capable de soulever des poids de l'ordre de cinq kilogrammes.