CONTRALATERAL MEDIAN NERVE AUTOGRAFT

N. JOSHI, X. MIR, R. BUSQUETS, J. SIRERA, A. NAVARRO-QUILIS

Interfascicular nerve autografting is a useful method to repair nerves with gaps, mainly if the removal of a nerve does not imply a defect to the donor area. Final results of peripheral nerve repair definitively depend on the size of the nerve gap, the level of the injury and the time elapsed from the time of injury until the nerve is repaired.

Keywords : median nerve ; autograft.
Mots-clés : nerf médian ; greffe autologue.

INTRODUCTION

In median nerves palsies, the greatest functional deficit is sensory loss in the hand, loss of opposition and, in high lesions, loss of extrinsic flexors.

Nerve grafting has been performed since more than 100 years (e.g. : Philipeaux and Vulpian 1876) (2, 4). Since then, techniques and results have progressed. Bielschowsky and Unger, in 1917, proposed that cutaneous nerves should be used as grafts (2). Taylor in 1976 successfully performed the first vascularized free nerve grafting. However nerve grafting is still considered inferior in performance to end-to-end suture by many authors (1, 3, 4, 6).

We report the results of a contralateral autogenous median nerve grafting, performed in a patient who had had an injury to the median nerve of his right upper extremity, and presented a traumatic amputation of the left hand.

CASE REPORT

A 51 year-old fisherman was refered to us fifteen months after an accident which had caused laceration of his right median nerve at elbow level, together with an amputation of left upper extremity at the wrist level.

Physical examination of the right hand showed an absence of sensibility of the median territory and no contraction either of the thenar muscles or of flexor muscles of the first, second and third fingers. Electromyography confirmed the laceration of the right median nerve at elbow level. The skin that covering the amputated stump of the left extremity was dorsal, and its sensibility depended on the sensitive radial branch and the cubital nerve.

The treatment consisted in microsurgical group fascicular nerve grafting using the median nerve of the other forearm as a donor. The length of the nerve grafting was 11 cm, larger than the gap (9 cm). Firstly, the area of injury was explored, the nerve was mobilized from its bed and the scarred ends were removed. We separated the fascicles into groups and sectioned them at different levels in order to avoid sutures at the same level ; that is, to prevent transverse fibrosis. Then, we removed and transposed 11 cm of median nerve of the left forearm. The segment of nerve we used as a graft was removed from the left median nerve, at the same level as the gap in the right median nerve, in order to have the most similar configuration between both donor and receptor nerves. Corresponding group fascicles, from both proximal and distal cut ends of the receptor nerve, were

Correspondence and reprints : N. Joshi, Aribau 25, 5°-1ª, 08011 Barcelona, Spain.

joined by the graft and sutured with a 9/0 nylon filament.

The patient went through rehabilitation sessions after 3 weeks of immobilization of his right upper extremity with a cast above the elbow.

Sensory and motor evaluation was made during follow-up based on the system described by the *Nerve Injury Committee of British Medical Research Council.* The patient was requested to rank pain, numbness, weakness, cold intolerance and paresthesia.

At 12 months postoperatively, there was protective sensibility and reinnervation up to the *flexor digitoum profundus* of the index muscle. At 18 months postoperatively, there was pain sensation and tactile sensibilility throughout the autonomous zone without over-reaction and all muscles contracted against strong resistance with some independent action (fig. 1).

DISCUSSION

Nerve repair is best dealt with by primary suturing of the ends, but this approach is not always possible. When a significant gap is produced in a nerve, a nerve grafting achieves better results than a suture under tension (2, 3, 4).

	Fibrillation	Fasciculation	Voluntary action
Flexor Pollicis Longus muscle	+ + +	–	0
Thenar eminence median nerve	+ + +	–	0

Electromyography before surgery : Complete denervation of the median nerve muscles.

	Fibrillation	Fasciculation	Voluntary action
Flexor Carpi Radialis muscle	+ + +	–	0
Flexor digitorum muscle	+ + +	–	0

Electromyography 6 months postoperatively : Absence of reinnervation signs in the forearm muscles.

	Fibrillation	Fasciculation	Voluntary action
Flexor Carpi Radialis muscle	+ + +	–	1
Flexor digitorum muscle	+ + +	–	1
Thenar eminence median nerve	+ + +	–	0

Electromyography 12 months postoperatively : Reinnervation until the flexor digiti indicis muscle.

	Fibrillation	Fasciculation	Voluntary action
Thenar eminence (median nerve)	+ +	–	1

Electromyography 19 months postoperatively :
All muscles contract against strong resistance with some independent action.

Legend : *Fibrillation and fasciculation*
– *absence*
\+ *occasional*
\+ + *low*
\+ + + *abundant*

Voluntary action
0 *none*
1 *considerable*

Fig. 1.

Historically, poor functional results have been reported after median nerve grafting (5). Studies by Wynn-Parry and Salter, Dellon, Walton and Finseth and Novak demonstrated that good hand function can occur after median nerve repair (5).

There are many possibilities for repairing a median nerve gap (6) : a conventional group fascicular autograft (2, 3) ; a free vascularized nerve autograft ; a nonneural tissue grafts (1) ; a prosthetic nerve graft ; an allograft (1) ; across-union procedure utilizing the dorsal cutaneous nerve of the hand (branch of the ulnar nerve) to provide regenerating axons to the sensory fasciculi of the median nerve at the wrist, particularly the thumb and the index (6).

An autogenous nerve grafting is the most common method to treat patients with a significant gap (2, 3), but this technique is limited in configuration, length and quantity and implies a secondary neurologic deficit. The most common donor nerve is sural nerve because of its acceptable donor defect, long length and accessibility. Another advantage of sural nerve is its monofascicular configuration. Polifascicular nerves have conective tissue between the fasciculi. This makes exoneurolisis necessary in order to avoid the fibrosis. On the other hand, to restore the median nerve, five or six grafts of sural nerve are necessary to maintain the same diameter. This approach may imply the necessity of using both sural nerves, with more nerve deficit.

To avoid these problems, several investigators used allografts (1), nonneural tissue (muscle or tendon autograft) (1) or prosthetic nerve grafts (resolvable polyorthoester tube) to bridge nerve gaps. The outcomes of these approaches are uncertain. Nerve allografts can provide abundant grafting material without residual donor defects and, even though results in the laboratory are equivalent to autografts, in human there may be a rejection. Regeneration through the prosthetic tube demonstrates no difference as compared with the autogenous nerve grafts, but the regeneration is delayed by 4 to 6 weeks and intolerance to the polyorthoester tube may appear.

The graft that matches best the receptor nerve, in configuration and width, would be the best. Therefore the best graft seems to be autogenous graft, despite of its limitations. In our case the use of autogenous nerve grafting did not mean a secondary neurologic deficit because the skin that covered the amputated stump was dorsal, and its sensibility depended on sensitive branches from radial and ulnar nerves. It also did not interfere with using a hand orthesis. The nerve grafting we used was not limited in configuration because it was the same nerve (median) and the same section. The graft was of the same width and had the same number, type and distribution of fascicles as the receptor nerve. The fascicular groups of the median nerve are nearly constant. In the distal half of the forearm, 3 fascicular groups may be identified and traced as separated entities. It was possible to joint groups of fascicles of the same configuration (size and type) and, thus, to minimize axonal wasting. The constancy of fascicular groups of the median nerve not only allows to join groups of fascicles of the same configuration between the trunk nerve and the donor nerve, but also to group fascicular repairs. This technique is preferable to fascicular repair because it requires less dissection and causes less surgical trauma and resultant scarring. In addition, motor-sensory differentiation is helpful to restore particularly the sensory function.

We did not use vascularized nerve grafting. Results of vascularized grafts and of conventional grafts are placed in healthy beds. Vascularized nerve grafts performed better than free nerve grafts for sensory receptive areas and for myelinated fibre diameters distal to the graft, but not for the motor function (1). Histological results are in favour of vascularized nerve grafting (1), which leads to earlier regeneration of axons and a greater density of large axons. However if thrombosis occurs, the graft fails completely. The rate of thrombosis in some series is high, mainly when repairing digital nerves. The surgical technique is more difficult and time concerning. Therefore, vascularized nerve grafts have limited applications, being indicated in poorly vascularized scarred beds. Even though, for some investigators it is preferable to repair the tissue bed so as to promote revascularization of conventional nerve grafts.

Finally, regardless of the type of graft, other factors influence the results of nerve repair : the type of nerve involved (unmixed nerves have a

better repair), the age of the patient (better in young patients), the level of injury (the more proximal the lesion the greater the percentage of nerve cell damaged and the poorer the result), the size of the gap (The Nerve Injury Committee of British Medical Research Council found that a gap of more than 5 cm is prejudicial to motor recovery), the lag of time before repair (the longer the time elapsed the poorer the motor recovery), the severity of the original trauma (associated injuries complicate nerve recovery), the tension at the suture site, the shrinkage of scar tissue and the approximation of the fasciculi (3).

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SAMENVATTING

N. JOSHI, X. MIR, R. BUSQUETS, J. SIRERA. Autologe zenuwente door middel van een contralaterale nervus medianus.

De auteurs rapporteren de resultaten van een autologe zenuwente bij een patiënt met een oud traumatisch letsel van de rechter nervus medianus thv. de elleboog. In hetzelfde ongeluk had hij een traumatische amputatie thv. de linker pols opgelopen, zodanig dat een segment van de linker nervus medianus kon gebruikt worden om het defekt rechts te overbruggen. Bevredigend resultaat na follow-up van 18 maanden.

RÉSUMÉ

N. JOSHI, X. MIR, R. BUSQUETS, J. SIRERA. Autogreffe à l'aide nerf médian contralatéral.

Les auteurs rapportent les résultats d'une greffe nerveuse autologue réalisée chez un patient qui présentait une section traumatique ancienne du nerf médian droit au niveau du coude. Il avait présenté dans le même accident, une amputation traumatique du membre supérieur au niveau du poignet gauche, ce qui a permis d'utiliser sans dommage un segment de son nerf médian gauche pour combler le défect du côté droit. Le résultat est satisfaisant avec un recul de 18 mois.