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Contralateral medial pectoral nerve transfer with free gracilis muscle transfer in old brachial plexus palsy

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ABSTRACT

Background: There is a very small chance of success for nerve reconstruction in patients with old total brachial plexus palsy who visit after 2 y or suffer from flail upper extremity after the failure of previous operations.

Materials and methods: For these individuals, the surgeon has to find a recipient motor nerve to perform free gracilis muscle transplantation. In this study, contralateral medial pectoral nerve from the intact side was transferred to the damaged side as a recipient nerve. Then, in the second operation, approximately 15 mo later, the free gracilis muscle transfer was performed. The gracilis muscle was removed and transferred to provide elbow and finger flexion.

Results: In a retrospective study (over 10 y), we reviewed 68 patients for whom this method had been performed. After 1 y, the results were investigated using the Medical Research Council grading system. Five patients did not participate in the study, and the muscle underwent necrosis in two patients. M3 and M4 muscle power was regained in 26 (42.6%) and 21 (34.4%) patients, respectively.

Conclusions: Contralateral pectoral nerve transfer followed by free muscle transplantation can be a good option for patients with old total brachial plexus palsy.

Introduction

Most brachial plexus injuries are in the form of the avulsion of the nerve root from the spinal cord with preganglionic injury.[1-5] These patients have a very poor prognosis of regaining acceptable performance. Total brachial plexus palsy leads to severe and chronic disorders that require timely and long-term treatment. Neural injuries cause sensory and motor disorders, muscular atrophy, and deformation. Multiple surgical operations lead to many problems and lack of cooperation. In these cases, different specialists should contribute and cooperate to achieve the best result.

Nowadays, nerve transfer[6] is usually done in acute injuries and those that have occurred in less than a year.[7-12] There is an ongoing attempt to increase the number of intra- and extraplexal donor nerves for nerve reconstruction in these patients. Traditionally, intraplexal nerves including medial pectoral, thoracodorsal (ipsilateral), and an ipsilateral C7

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nerve were used for patients with partial brachial plexus injury, while the hypoglossal, phrenic, motor nerve of cervical plexus, platysma motor branch, spinal accessory, and intercostals nerves were used for cases with pan-plexus injuries.[13-21]

However, in cases who first visit 2 y since the injury, muscles are already atrophied and nerve transfer alone is not helpful. In these cases, alternative techniques can be used. In the most complete method, a motor nerve is transferred as a recipient nerve and also an appropriate muscle as a free functional muscle to induce elbow flexion alone or synchronous elbow and finger flexion in the affected limb.[22-24]

Materials and methods

Ethical statement

This study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (IR.SBMU.MSP.REC.1396.421). A written informed consent was obtained from all the patients for participate in study and also surgery.

Patients

From December 2003 to 2015, we reviewed 68 patients who had previous brachial injury approximately more than 2 y ago and received no treatment or had undergone an ineffective nerve transfer surgery at least 1.5 y ago by another surgeon. In all the cases, other extraplexal nerves such as ipsilateral intercostals or the accessory nerve had been used or were unusable, and there was no proper ipsilateral donor nerve. Therefore, we used the healthy nerve of the other side as the donor.

At first, the surgery that had two stages with a long interval (about 15 mo) was explained to the patients and their families. The possibility of the failure of the first or second stages of the surgery and its probable complications were completely explained.

The patients then underwent contralateral pectoral nerve transfer and, if successful, free gracilis muscle transfer was performed after 12-15 mo. All of the surgeries were performed by a team of two hand surgeons. During follow-up, the patients were visited in the clinic by hand therapists. They were under regular supervision by a permanent team of physiotherapy and occupational therapy. After 12 mo, muscle power was recorded using the British Medical Research Council and chuang modification as follows:

M5: strength against four-finger (examiner) resistance.
M4: strength against one-finger (examiner) resistance for longer than 30s.
M3: active movement against gravity.
M2: active movement with gravity eliminated.
M1: flicker (trace of contraction).
M0: no contraction.

Surgical procedure

Before any venture, the approximate distance between the medial pectoral nerve of the intact side and the injured arm was measured, which was variable (up to 45 cm) depending on the individual's body size (Fig. 1). Thus, the sural nerves had to be released for more than 45 cm. As most patients were tall and thin, we had no deficit of nerve graft length (Fig. 2). After general anesthesia in a supine position, a 4- to 7-cm-long incision was made at about 3-4 cm below the clavicle of the intact side and between the central and lateral third of the clavicle. The medial pectoral nerve was explored, and its integrity was confirmed with a nerve stimulator. The nerve was then transected. A subcutaneous tunnel was made from this incision site toward the proximal part of the paralyzed arm and a 0.0 nylon suture was passed through this tunnel so that the sural nerve could easily pass through it. Then, the distal end of the sural nerve was sutured to the transected proximal end of the medial pectoral nerve (using a 10-0 nylon suture) with the aid of loupe magnification. The proximal end of the sural nerve was then passed from the tunnel and tagged at the upper part of the paralyzed arm to facilitate its detection in the second-stage surgery. Postoperative care, particularly the restriction of the intact arm abduction for at least 3 wk, was explained to the patients. After 3 wk, both upper limbs underwent physiotherapy. Within the following 15 mo, nerve regeneration was evaluated using Tinel's sign. When the positive Tinel's sign was

Fig. 1 – Distance between the intact side of medial pectoral nerve and the injured arm. (Color version of figure is available online.)