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Technique and Method

Microsurgical decompression of the median nerves for treating diabetic peripheral neuropathy in the upper limbs: A 21-month follow-up*

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Abstract

BACKGROUND: Peripheral nerve injured by abnormal glucose metabolism is compressed, which is an important etiological factor of diabetic peripheral neuropathy (DPN). Microsurgical decompression of peripheral nerve maybe effectively releases the symptoms of DPN.

OBJECTIVE: To investigate the curative effects of microsurgical decompression of median nerves for treatment of DPN in upper limbs.

DESIGN: Case-follow up observation.

SETTING: Department of Orthopaedics, Department of Neurosurgery, China-Japan Friendship Hospital, Ministry of Health.

PARTICIPANTS: Twelve patients with DPN in upper limbs (19 hands) who received treatment in the Department of Orthopaedics, Department of Neurosurgery, China-Japan Friendship Hospital, Ministry of Public Health between March 2004 and July 2006 were involved in this experiment. The involved patients, 5 male and 7 female, were aged 44 to 77 years, with DPN course of 6 months to 16 years. They all met 1999 WHO diabetic diagnosis criteria. Both two hands had symptom in 7 patients, and only one hand had symptom in 5 patients. Informed consents of detected items were obtained from all the patients, who also received 21 months of follow-up treatment.

METHODS: ①Operation was carried out under the anesthetic status of brachial plexus. Under an operating microscope, transverse carpal ligament was exposed. Subsequently, transverse carpal ligament, forearm superficial fascia and palmar aponeurosis were fully liberated, and then part of them was cut off. Connective tissue around median nerve, superficial flexor muscle of fingers, radial flexor, palmaris longus and other flexor tendons were completely loosened. Finally, epineurium was opened with microinstrument for neurolysis. After tourniquet was loosened, and bipolar coagulator was used to stop bleeding, and the incision was closed. ② In postoperative 21 months, the subjective symptom, two-point discrimination (The smallest distance of two normal points was 3 to 6 mm), nerve conduction velocity and action potential amplitude (short abductor muscle of thumb end Lat < 4.5 ms; Motor nerve conduction velocity of forearm > 50 m/s), *etc*. of all the patients were followed up.

MAIN OUTCOME MEASURES: The objective evaluation and long-term follow up of curative effect of microsurgical decompression of median nerves for treatment of DPN in upper limbs.

RESULTS: Twelve patients with DPN in upper limbs participated in the final analysis. ① After operation, numbness and pain symptom releasing 100% were found in 19 hands of 12 patients with DPN. During follow up, numbness and recrudescent pain symptom were found in one hand（5%，1/19）. ②Postoperatively, index finger two point discrimination in 15 （94%，15/16）hands recovered to normal. ③ nerve conduction velocity and action potential amplitude improved completely . ④ Two hands（2/19，10%）had poor healing at incision, and they late healed at postoperative 1 and 1.5 months, respectively.

CONCLUSION: Long-term follow-up results show that microsurgical decompression is an effective method to treat DPN in upper limbs.

Key Words: diabetic neuropathies; peripheral nerves; median nerve; microsurgery

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INTRODUCTION

Diabetic Peripheral Neuropathy (DPN) is the most common diabetic neuropathy. In the carpal canal, ulnar nerve canal at elbow and other narrow areas, once peripheral nerve injured by abnormal glucose metabolism is compressed, DPN will occur. Performing microsurgical decompression of DPN on above-mentioned narrow areas obviously releases the symptoms of DPN, which provides a new method for treatment of DPN. In this experiment, we used microsurgical decompression of median nerve in patients with DPN in upper limb for observing its curative effects.

SUBJECTS AND METHODS

Subjects

Twelve patients with DPN in upper limbs (19 hands) who received treatment in the Department of Orthopaedics, Department of Neurosurgery, China-Japan Friendship Hospital, Ministry of Public Health between March 2004 and July 2006 were involved in this experiment. The involved patients, 5 male and 7 female, were aged （62±12）years ranging from 44 to 77 years, with average diabetic course of 9 years ranging from 4 to 21 years and average DPN course of 3.7 years ranging from 6 to 16 months. They all met 1999 WHO diabetic diagnosis criteria [1]. All the patients did not suffer from vascular lesion, alcoholic poisoning, phototoxis, heavy metal poisoning, cancer, vitamin deficiency, uremia and other diseases. Both two hands had symptom in 7 patients, and only one hand had symptom in 5 patients. Clinical symptoms: Radial 3-and-a-half finger palmar surface numbness was found in 16 affected hands from DPN upper limbs, pain in 10 hands, glove-like sensory disorder in 4 hands, weak strength and clumsiness of thrum and index finger in 10 hands, and weak strength of the whole hand in 4 hands. Physical sign: superficial sensation decreasing of radial 3-and-a-half finger palmar surface was found in 19 hands, sensory disorder of the whole hand in 6 hands, thenar muscle atrophy in 12 hands, internal muscle atrophy in 6 hands, weak abduction strength of thumb in 10 hands, weak opposition strength of thumb and index finger in 7 hands, poor fine action in 10 hands, widening two-point discrimination of index finger (> 4 mm) in 16 hands and Tinel syndrome-positive at wrist in 18 hands. Auxiliary examination: In the neuroelectrophysiologic examination, nerve conduction velocity slowing and nerve action potential amplitude decreasing of median nerve as well as preoperative blood glucose level within normal range were found in all the 19 hands. Informed consents of detected items were obtained from all the patients.

Methods

Operative procedure

Operation was carried out under the anesthetic status of brachial plexus. Tourniquet, with blood pressure of 33.25－37.24 kPa, was used for 30 to 50 minutes. An arc incision was made at palmar aspect of the wrist. Under an operating microscope, transverse carpal ligament was exposed. Subsequently, transverse carpal ligament, forearm superficial fascia and palmar aponeurosis were fully liberated, and then part of them was cut off. Connective tissue around median nerve, superficial flexor muscle of fingers, radial flexor, palmaris longus and other flexor tendons were completely loosened. Finally, epineurium was opened with microinstrument for neurolysis. After tourniquet was loosened, and bipolar coogulator was used to stop bleeding, and the incision was closed.

Postoperative follow up

At postoperative 21 months, the subjective symptom, two-point discrimination, nerve conduction velocity and action potential amplitude, wound healing, etc. of all the patients were followed up. In the test of two-point discrimination of index finger, patients were asked to close their eyes. A pair of allotted compasses was used to stimulate the skin at two points. When patients had the sensation from two points, the distance between two feet of compasses was contracted until patients had sensation from one point. The normal smallest distance between two points was 3 to 6 mm. In the neuroelectrophysiologic examination, super-power electricity was used to stimulate the skin at 2 or over 2 points of neural pathway. Compound muscle action potential (CMAP) was recorded from this nerve-dominated some piece of muscle, and CMAP latency L_1 at distal stimulating point and CMAP latency L_2 at proximal stimulating point were measured, and conduction velocity was calculated according to the formula: MCV= distance between two stimulating points (m)/($L_1 - L_2$)(s). Short abductor muscle of thumb end Lat < 4.5 ms and motor nerve conduction velocity (MNCV) of forearm > 50 m/s were normal. MNCV speeding up and /or action potential amplitude increasing indicated the patients were improved.

RESULTS

Quantitative analysis of the participants

Twelve patients with DPN in upper limbs participated in the final analysis.

Follow-up time and results

Twelve patients with DPN in upper limbs all received 21-month follow-up treatment. After operation, numbness and pain symptom releasing 100% were found in 19 hands of 12 patients with DPN. During follow up, numbness and recrudescent pain symptom were found in one hand （5%, 1/19）. Postoperatively, index finger two point discrimination in 15 （94%, 15/16） hands recovered to normal. Nerve conduction velocity and action potential amplitude improved