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Case Report
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A Gastrocnemius Muscle Perforator Adiposal Flap to Wrap the Peroneal Nerve for Recurrent Peroneal Nerve Adhesion Neuropathy: A Case Report

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Abstract

We experienced a case of recurrent adhesion neuropathy after neurolysis.

There are some reports on recurrent peripheral nerve palsy. Among them, a substantial number of investigators have mentioned treatment of recurrent carpal tunnel syndrome by covering with muscles, flaps, and adiposal flaps. However, there is no report on the use of a perforator adiposal flap for recurrent peroneal nerve palsy. We experienced a case of reoperation for recurrence after neurolysis for peroneal nerve palsy and good recovery of the paralysis by wrapping the peroneal nerve with a gastrocnemius muscle perforator adiposal flap. A 50-year-old man had an accident, following which he was diagnosed with right tibial nerve and peroneal nerve palsy. Two months after the injury, we performed neurolysis of the tibial and peroneal nerves. After the procedure, muscle strength showed a tendency toward recovery; however, muscle weakness of the peroneal nerve recurred. The patient was diagnosed with recurrent peroneal nerve palsy due to adhesion neuropathy. Eleven months after the first procedure, secondary neurolysis of the peroneal nerve was performed. During the second procedure, after performing the neurolysis, we covered the peroneal nerve with a gastrocnemius muscle perforator adiposal flap (70 mm × 60 mm) to prevent recurrent adhesion. Twelve months after the second procedure, the muscles on the affected side recovered as much strength as the muscles on the healthy side.

Based on these findings, we concluded that adhesion could be effectively prevented by wrapping the nerve with an appropriate flap in addition to neurolysis in patients with adhesion neuropathy.

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Introduction

Some studies have reported on recurrent peripheral nerve palsy [1]. Several of these studies have mentioned treatment of recurrent carpal tunnel syndrome by using muscle and adiposal flaps [2-4]. Ohta et al. [5] reported a case of recurrent peroneal neuropathy using the proximally based sural fasciocutaneous flap following re-neurolysis. Sural fasciocutaneous flap prevents re-adhesion in a small area; a larger flap is required to prevent more extensive adhesions, as observed in the present case. Therefore, we treated recurrent peroneal nerve palsy using the gastrocnemius muscle perforator adiposal flap to cover a wider area. To our knowledge, no study has reported on the use of a perforator adiposal flap for recurrent peroneal nerve palsy. We managed a patient who required reoperation which was performed by wrapping the peroneal nerve with a gastrocnemius muscle perforator adiposal flap for recurrent peroneal nerve palsy after neurolysis and showed good recovery of the paralysis.

Case Presentation

A 50-year-old man had an accident, and his right popliteal region was held between the handle and seat of a vehicle while driving. It was difficult to flex and extend the right ankle and right toes immediately after the injury. He was diagnosed with right tibial nerve palsy and peroneal nerve palsy and was conservatively treated. Two months after the injury, there was poor recovery of the function of both nerves, and the patient first visited our clinic.

At the first consultation, the Manual Muscle Test (MMT) findings of the Tibial Anterior muscle (TA) and Extensor Hallucis Longus (EHL) were graded as M1 and those of the Gastrocnemius (Gastroc) and Flexor Hallucis Longus (FHL) were graded as M2. Five months after the injury, the MMT findings of the TA, EHL, triceps, and FHL were graded as M2. We thought that the recovery

Figure 1: Severe adhesion of the peroneal nerve (arrow) is observed.

Figure 2: A gastrocnemius muscle perforator adiposal flap (70 mm × 60 mm) is elevated.

Figure 3: The perforator adiposal flap is rotated proximally.

Figure 4: The peroneal nerve is wrapped with the perforator adiposal flap.

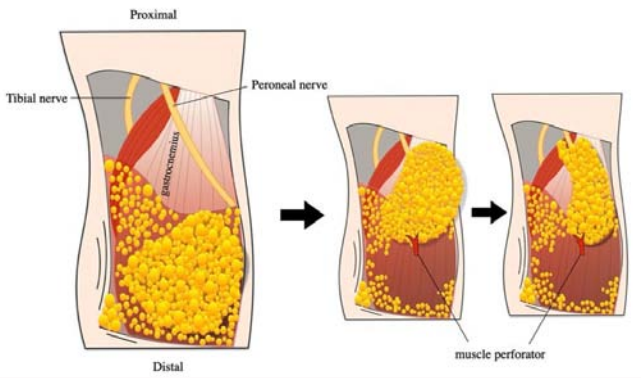

Figure 5: The gastrocnemius muscle perforator adiposal flap procedure for wrapping the peroneal nerve.

was insufficient, and neurolysis of the tibial and peroneal nerves was performed. Operative findings showed that both nerves strongly adhered to the surrounding scar tissue. The adhesion of the peroneal nerve was greater than that of the tibial nerve.

Six months after surgery, the MMT findings of the TA, EHL, Gastroc, and FHL were graded as M3, and their strength tended to recover. However, 11 months after surgery, the MMT findings of the TA and EHL were graded as M2 and M1, respectively. Exacerbation of paralysis involving the peroneal nerve was observed. In an electrophysiological study, a decrease in motor nerve conduction velocity, prolonged distal latency and low amplitude of the TA were revealed, and we made a diagnosis of recurrent peroneal nerve palsy due to adhesion neuropathy.

Eleven months after the first surgery, secondary neurolysis of the peroneal nerve was performed. During the operation, severe adhesion of the peroneal nerve was observed, and the surrounding scar tissue formation was remarkable, as noted previously. First, the peroneal nerve was identified and dissected from the surrounding scar tissue and neurolysis was performed (Figure 1). Second, coverage of the peroneal nerve with a gastrocnemius muscle perforator adiposal flap was planned to avoid recurrent adhesion. The skin incision was extended distally, and the gastrocnemius muscle perforator was identified. We elevated a perforator adiposal flap (70 mm × 60 mm) (Figure 2). After the elevation of the flap, the air tourniquet was deflated, and we confirmed sufficient blood flow of the adiposal flap. The flap was rotated proximally and was wrapped around the peroneal nerve (Figure 3 and 4). We wrapped the peroneal nerve with an adiposal flap for adhesion at the proximal fibular head; the soft tissue was not bulky and tight (Figure 5).

Two months after the second surgery, the MMT findings of the TA, EHL, triceps, and FHL were graded as M4. Twelve months after the second surgery, the strength of all muscles on the affected side recovered to as much as the strength of the muscles on the healthy side. The final follow-up was 1.5 years after the second operation, the recovery course was good.

Discussion

Recurrent peripheral nerve adhesion neuropathy is often difficult to treat, and surgical intervention remains a challenging problem. As postoperative adhesion may cause impaired nerve gliding and intraneural fibrosis owing to compression from surrounding scar tissues, a nerve conduction disorder can occur. It is important to cover the nerve with well-vascularized soft tissue to create a cushion between the nerve and the surrounding tissue to prevent adhesion [4].

There is a case series of seven patients with recurrent median nerve neuropathy treated by revision surgery involving median nerve neurolysis and wrapping with a radial artery perforator adipose flap [4]. Additionally, there are many reports on the treatment of recurrent peripheral neuropathy in the median nerve [1]. Coverage of the median nerve requires well-vascularized soft tissues, such as an abductor digiti minimi muscle transposition flap, a palmaris brevis flap, and a hypothenar fat pad flap [3,6,7].

The problems related to coverage with the muscle and the fascia fat flap is motor loss, limited arc of motion, and poor shape due to the flap. To overcome these issues, Uemura et al. [4] reported the use of a radial artery perforator adiposal flap. The advantages of radial artery perforator adiposal flap over a fascial flap are preservation of the radial artery, reduced bulkiness, reliability of perforators to the adiposal flap, and good cushioning.

There are few reports on reduced neuropathy with the use of a perforator adiposal flap. Namba et al. [8] reported neurolysis of the lateral thigh cutaneous nerve using a deep inferior epigastric perforator adiposal flap. The authors described the feasibility of the perforator adiposal flap after neurolysis.

We experienced a case of recurrent adhesion neuropathy after neurolysis. We performed neurolysis of both, the tibial and the peroneal nerve during the first operation. We believe the tibial nerve recovered well as compared to the peroneal nerve because the adhesion and scar tissue formation surrounding the tibial nerve was not severe as compared to that around the peroneal nerve.

A second neurolysis and coverage of the peroneal nerve with a perforator adiposal flap resulted in satisfactory recovery of the neuropathy. Considering the pressure on the nerves, the tightness of the soft tissue and the skin is crucial. The adipofascial flap is inevitably bulky. Therefore, instead of an adipofascial flap, we used an adiposal flap without the fascia. Based on the findings, it was considered that adhesion could be effectively prevented by nerve wrapping with an appropriate flap in addition to neurolysis for adhesion neuropathy.

The gastrocnemius muscle perforator adiposal flap has the following advantages: 1) both, neurolysis and the adiposal flap transfer can be performed at the same skin incision. 2) A rich fat tissue on the back of the lower leg can be used. 3) Elevating an adiposal flap is technically easy because of the pedicled perforator flap. 4) It is possible to include multiple perforators, and there is a high reliability of blood circulation.

However, the disadvantages of this flap are as follows: 1) anatomically, the localization of the perforator varies and needs to be confirmed preoperatively using ultrasonography. 2) The incision needs to be longer than that for the neurolysis.

The gastrocnemius muscle perforator adiposal flap is one of the muscle perforator flaps of the peroneal artery. According to the reports of vascular anatomy analysis of the peroneal artery, 1 to 4 perforators were found within 9 cm to 18 cm distal to the popliteal fascia [9]. The effect rate of peroneal nerve neurolysis has been reported to be 75% to 95%, but there is no report of a recurrent case [10].

Alternatives to a gastrocnemius muscle perforator adiposal flap are the posterior tibial artery perforator fat flap, popliteal perforator flap, and sural artery flap. Other flaps require additional incisions that are located far from the coverage site of the peroneal nerve. We believe that pearls and pitfalls for elevating this perforator flap are described. We do not isolate the perforator and preserve fat tissue around the perforators. Considering the folding back of the adiposal flap, we elevate the adiposal flap a little longer than required. We need to be cautious to prevent twisting of the perforator when the flap is rotated. Preoperative ultrasound evaluation is necessary.

To our knowledge, there is no report of a case in which a perforator adiposal flap was used to cover the adhesion associated with peroneal nerve neuropathy. This is the first report of the use of a perforator adiposal flap for peroneal nerve adhesion neuropathy.

The advantages of a gastrocnemius perforator adiposal flap over a fascial adiposal flap include reduced bulkiness and good cushioning, as well as reliability of perforators to the adiposal flap and sufficient size for nerve wrapping.

We obtained a satisfactory result with the use of a gastrocnemius perforator adiposal flap for nerve covering. In cases where adhesions and scars are severe, it is worth considering nerve wrapping with an adiposal flap after neurolysis at the primary operation.

It is novel that the peroneal nerve palsy that recurred only after neurolysis was treated with a gastrocnemius muscle perforator adiposal flap and there was a good recovery from the palsy.

In conclusion, wrapping with a gastrocnemius perforator adiposal flap is a useful option to treat adhesion neuropathy of the peroneal nerve.

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