



Median Nerve Repair Using Sural Nerve Grafting: A Case Report

Eko Prasetyo,¹ Maximillian C. Oley,¹ Ferdinan Tjungkagi,¹ Yovanka Manuhutu,¹ Edwin H. Sitorus²

¹Division of Neurosurgery, Department of Surgery, Faculty of Medicine, Universitas Sam Ratulangi - Prof. Dr. R. D. Kandou Hospital, Manado, Indonesia

²Department of Surgery, Faculty of Medicine, Universitas Sam Ratulangi – Prof. Dr. R. D. Kandou Hospital, Manado, Indonesia

Email: edwinsitorus24@gmail.com

Received: January 26, 2023; Accepted; November 24, 2023; Published online: November 26, 2023

Abstract: Peripheral nerve injuries (PNIs) have increased to nearly 2.8% of all trauma cases. It often occurs in the upper extremities, such as the median nerve. EMG can be used to confirm a PNI diagnosis. When continuity defects are present in the injured nerve, a nerve graft procedure may be indicated. The most common donor nerve for repair is the sural nerve. Different surgical options are available for the repair of PNI. We presented a 39-year-old woman whose left hand was cramping and did not fully clench. On physical examination, there was an irregular scar on the left arm 1/3 upper region. Sensory deficits were found in the distribution areas of the median nerve, from digiti 1 to 3 of the manus sinistra. EMG showed the lesion of the left median nerve, an axonotmesis was suspected. The patient was then treated with sural nerve grafting to the median nerve using fibrin glue. The postoperative result revealed improvement in hand function. Grafting sural nerve to median nerve using fibrin glue was rarely performed. According to several studies, nerve grafts usually used 6-0 sized synthetic, monofilament, non-absorbable polypropylene sutures. however, there was no difference in the results between fibrin glue and sutures, both have good outcomes. In conclusion, repairing of the median nerve injury using autograft (sural nerve) and fibrin glue can be an option to restore the function of the hand.

Keywords: peripheral nerve injury; median nerve; sural nerve; nerve grafting

INTRODUCTION

In the last two decades, peripheral nerve injuries (PNI) have increased almost 2.8% of all trauma patients. Peripheral nerve injuries are commonly involving the upper extremities. These injuries may cause significant deficits such as impaired functional recovery. Median and ulnar nerve injuries are examples of such lesions. To fully determine the extent of nerve damage, an electrical conduction test may be performed to determine the flow of electric current through the nerves. Two of these tests are electromyography and nerve conduction velocity.¹

The nerve graft acts to provide a source of empty endoneurial tubes through which the regenerating axons can be directed. Many conditions must be met for a nerve to be considered as a potential graft. First, the relationship between the surface area and the diameter of the graft must be optimal to allow rapid revascularization. The donor site defect from sacrifice of any given nerve must be acceptable for the patient. The harvested nerve must be long enough to ensure a tension-free anastomosis with the adjacent joints in full extension. Finally, the cross-sectional area and number of fascicles should match those of the recipient nerve at the level of injury as closely as possible.^{2,3}

When continuity defects are present in the injured nerve or created in preparation of the nerve for repair, a nerve graft procedure may be indicated. The two most common donor nerves for repair are the sural and the great auricular nerves.⁴

Modern surgical techniques like intra-operating electrophysiology monitoring, microscopic neurosurgery, and nerve grafting techniques have encouraged surgeons to treat PNI patients more efficiently than before. Different surgical options are available for repair of PNI, inter alia direct end-to-end repair, end-to-side repair, nerve grafting and nerve transfer. Different techniques of nerve anastomosis are epineural repair, grouped fascicular repair, and fascicular repair.⁵ Autograft has shown a better outcome than allograft. The common harvesting sites for nerve grafts are sural nerve, lateral antebrachial nerve proximal to the elbow, medial antebrachial cutaneous nerve, a dorsal cutaneous branch of the ulnar nerve, and lateral femoral cutaneous nerve. In this case, lesion on the median nerve was treated by taking a graft from the sural nerve.⁶

CASE PRESENTATION

A 39-year-old woman with complaints of left hand could not fully clench and cramping. Initially he was cleaning the mirror at home, the mirror broke and pierced the patient's left arm in the 1/3 upper. She initially underwent toileting and suturing at a local hospital. the wound healed but there were residual symptoms such as loss of sensation in digits 1 to 3 of the left hand, the left hand could not be clenched properly, and cramp sensation.

On clinical examination, patient was conscious dan well oriented. Vital sign and general status within the normal range. There was an irregular scar on the 1/3 proximal of the volar site of left forearm, measuring about 3 cm, 3 cm, and 2 cm, respectively. She also had sensory deficits in the distribution area of the median nerve, digits 1 to 3 of the left hand, which could not be clenched perfectly (Figure 1). Laboratory results were within normal limits. Electromyography examination revealed that on motor nerve conduction study (NCS) examination, the left median nerve was found to have normal distal latency, decreased CMAP amplitude, and decreased KHS. On sensory NCS examination, the left median nerve cannot be elicited SNAP (Figure 2)



Figure 1. Physical examination pre-operative

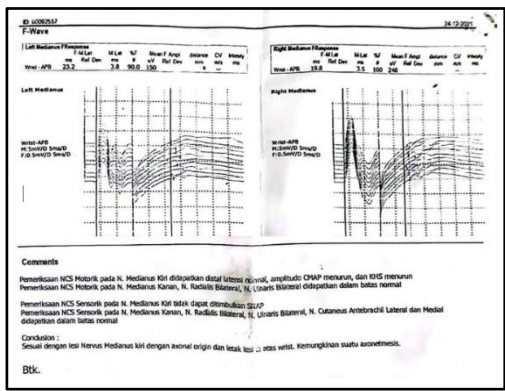


Figure 2. EMG pre-operative

Motor and sensory NCS examination of the right median nerve was within normal limits. The conclusion of the report was a lesion of the left median nerve with an axonal origin above the wrist, a possibility of an axonotmesis. Magnetic resonance imaging of the left hand showed minimal edema in the proximal teres, flexor carpi radialis, palmaris longus muscles of left forearm, with compression of the median nerve in these areas. Based on the history, physical examination along with supporting examinations, it can be concluded that there was damage of the median nerve, an axonotmesis. After proper examination and counselling, she was scheduled for left median nerve repair using sural nerve grafting under general anesthesia.

During the operation, the patient was in supine position, the left hand was stretched parallel to the left body, and the left leg was bent to the right. Asepsis and antisepsis of the operating area using Hibiscrub, alcohol, and betadine. The incision in the left hand followed the old wound, then it was widened using a spreader, and the left median nerve was identified. The pressure was visible due to the fibrotic tissue, then it was released, and a hematoma appeared on the 1/3 distal part of the median nerve. It was decided to amputate the part with hematoma which was further incised about 5 cm and was examined microscopically, followed by taking the left sural nerve graft, 2 cm behind the left lateral malleolus, the linear incision was deepened, and the sural nerve was identified. A graft of about 5 cm was taken, and the bleeding was controlled using bipolar. Autograft of sural nerve was then placed on an aluminum cross-section and tapered at the proximal and distal parts of median nerve, and then was sealed using fibrin glue until the autograft and the median nerve were perfectly fixed, then the aluminum cross-section was removed. The area was spooled with 0.9% NaCl until clean. There was no active bleeding, the surgical wound was closed layer by layer (Figure 3), and the operation was completed.

Postoperative recovery was uneventful. There was no new neurological deficit noticed after the surgery. Touch and temperature modules of sensations of her right hand started to appear and all lateral four fingers' power improved to 4/5 when she was examined after two months of surgery. She was able to use her left hand for feeding, dressing, and using the toilet after two months (figure 4, 5). A long-term follow-up is expected to show more precise postoperative recovery in the future.



Figure 3. Intraoperative procedure

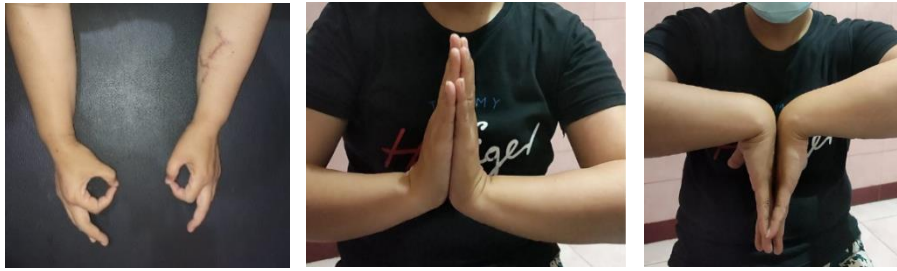


Figure 4. Physical examination post operative

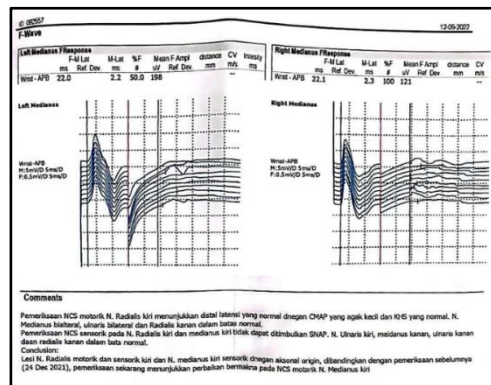


Figure 5. EMG post operative

DISCUSSION

This case report discussed about a median nerve injury patient who underwent nerve repair using an autograft. The findings in this patient were compared with those of other international cases. Grafting sural nerve to median nerve using fibrin glue are rarely performed. According to several studies, nerve grafting usually used 6-0 sized synthetic, monofilament, non-absorbable polypropylene sutures. however, there is no difference in the results between fibrin glue and sutures; both have good outcomes.¹

Ulnar nerve injuries can result in poor hand functions which require multiple surgeries with demanding technique and high cost. Prolonged period of sickness and subsequent functional loss can occur even with proper treatment. These injuries can result in added economic and social burdens to the patient and the community.⁷

Talha et al¹ used microsurgical anastomosis of median and ulnar nerves by sural nerve grafting. In this study, the ulnar nerves were grafted using a sural nerve. The ulnar and median nerve was microscopically repaired by two pieces of sural nerve end to end epineural anastomosis with 6-0 sized synthetic, monofilament, nonabsorbable polypropylene suture. The median nerve was repaired with musculocutaneous nerve graft by a similar microscopic technique. There was no new neurological deficit noticed post-surgery. Touch and temperature modules of sensations of the patient's right hand started appearing and all lateral four fingers' power improved to 4/5 two months post-surgery.^{1,2} Prasetyo et al⁸ performed a median and ulnar nerve repair using sural nerve graft in a patient diagnosed as total lesion of the right median and ulnar nerves, and partial lesion of the right radial nerve, and stated that the sural nerve graft was a great choice for peripheral nerve injuries with more benefits. However, prognosis depends on how early the treatment performed and how severe the lesion was. Moreover, Young et al⁹ performed their study on the effectiveness of nerve grafting of patients underwent median, ulnar and digital nerve surgery. A total of 38 patients were included in the study; 11 patients had the median nerve graft, seven patients had the ulnar nerve graft, and 33 had digital nerve graft. They also compared the

prognosis between grafted and non-grafted patients. It was concluded that sensory function improvement was significantly better in grafted patients in comparison to the non-grafted patients in case of ulnar nerve injuries. Ulnar nerve grafted patient's motor recovery was similar to the direct repair patients. Median nerve grafted patients had a significantly better result than the non-grafted patients.¹⁰⁻¹² In this case, sensory recovered earlier than motor but there was ulnar or median nerve predominance.

CONCLUSION

The repairing of the median nerve injury using autograft (sural nerve) and fibrin glue can be an option to restore the function of hand and improve the patient's quality of life.

Conflict of Interest

The authors affirm no conflict of interest in this study.

REFERENCE

1. Talha KA, Rob CF, Selina F, Khan PMH, Rahman N. Microsurgical anastomosis of median and ulnar nerves by sural nerve grafting. *Borneo Journal of Medical Sciences*. 2020;14(3):45–50. Available from: <https://www.researchgate.net/publication/344460763>.
2. Broeren BO, Duraku LS, Hundepool CA, Walbeehm ET, Zuidam JM, Hooijmans CR, et al. Nerve recovery from treatment with a vascularized nerve graft compared to an autologous non-vascularized nerve graft in animal models: a systematic review and meta-analysis. *PLoS ONE*. 2021;16(12):e0252250. Available from: <https://doi.org/10.1371/journal.pone.0252250>.
3. Garg SP, Hassan AM, Patel A, Ketheeswaran S, Galiano RD, Ko JH. A systematic review of nerve grafting, end-to-end repair, and nerve transfer for obturator nerve injuries. *Int J Gynecol Cancer*. 2022;32:1177-82. Doi: 10.1136/ijgc-2022-003565.
4. Grinsell D, Keating CP. Peripheral nerve reconstruction after injury: a review of clinical and experimental therapies. *BioMed Res Int*. 2014;2014:698256. Doi: 10.1155/2014/698256.
5. Matsuyama T, Mackay M, Midha R. Peripheral nerve repair and grafting techniques: a review. *Neurologia medico-chirurgica*, 2000;40(4):187-99. Available from: <https://doi.org/10.2176/nmc.40.187>.
6. Wolford LM, Stevao ELL. Considerations in nerve repair. *Proc (Bayl Univ Med Cent)*. 2003;16(2):152–6. Doi: 10.1080/08998280.2003.11927897.
7. Khater AME, Younis RA, El-Sayed NTM. Excision and inter-positional sural nerve graft for post-traumatic non-conducting ulnar nerve neuroma. *Egypt J Plast Reconstr Surg*. 2020;44(3): 401-6. Doi:10.21608/ejprs.2020.122293.
8. Prasetyo E, Oley MC, Manuhutu YN, Panduwinata D. median and ulnar nerve repair using sural nerve graft: a case report. *e-CliniC* 2024;12(1):107-10. Doi: 10.35790/ecl.v12i1.46482;
9. Young VL, Wray RC, Weeks PM. The results of nerve grafting in the wrist and hand. *Ann Plast Surg*. 1980;5(3):212-5. Doi: 10.1097/00000637-198009000-00006.
10. Ragel BT, Park GC, Brevard S. Median nerve repair with autologous sciatic nerve graft: a case report. *ISRN Surg*. 2011;2011:120367. Doi: 10.5402/2011/120367.
11. Mohseni M-A, Soleyman PJ, Ganj Pour J. Primary and delayed repair and nerve grafting for treatment of cut median and ulnar nerves. *Pakistan Journal of Biological Sciences (PJBS)*. 2010;13(6):287-92. Available from: <https://doi.org/10.3923/pjbs.2010.287.292>.
12. Slutsky D. A practical approach to nerve grafting in the upper extremity. *Atlas of the Hand Clinics*. 2005;10(1):73–92. Doi:10.1016/j.ahc.2004.09.005.