Simplified Cable Nerve Grafting with Nerve-Cutting Guides and Fibrin Glue

Reid W. Draeger¹ Donald K. Bynum, Jr.¹ J. Megan M. Patterson¹

¹Department of Orthopaedics, University of North Carolina School of Medicine, Chapel Hill, North Carolina, United States

J Hand Microsurg 2017;9:167–169.

Address for correspondence Reid W. Draeger, MD, Department of Orthopaedics, University of North Carolina School of Medicine, Campus Box #7055, 3102 Bioinformatics Building, Chapel Hill, NC 27599-7055, United States (e-mail: reid_draeger@med.unc.edu).

Abstract

Cable nerve grafting is the recommended surgical treatment for large peripheral nerve defects. Traditionally, this is performed by bridging a gap in the nerve with multiple autologous nerve cables, repairing the epineurium of each cable to the perineurium of a fascicle of the injured nerve that is similar in size to the graft. The authors present a new technique in which they used nerve-cutting guides to aid in the placement of fibrin glue to secure the sides of the cabled nerve graft together to facilitate handling of the cabled nerve graft and to expedite repair. Freshening the graft nerve ends after the application of fibrin glue using appropriately sized nerve-cutting guides allows for donor-recipient size match and epineurium-to-epineurium repair of the cabled graft to injured nerve. Though further follow-up is needed to determine long-term outcomes following this technique, early results are promising with clinical improvement seen in a similar timeframe to traditional grafting.

Keywords

- cable nerve grafting
- fibrin glue
- nerve-cutting guide

Ideas and Innovations

Cable nerve grafting is the recommended surgical treatment for large peripheral nerve defects.¹ Even with modern microsurgical techniques and equipment, cable nerve grafting is a technically demanding procedure with multiple microsurgical sutures placed from each autologous donor nerve cable into recipient perineurium.² Though the use of fibrin glue to join cabled nerve grafts together has been previously described, the authors detail a technical modification of this cable nerve grafting technique using nerve-cutting guides (Accurate Surgical & Scientific Instruments Corporation, Westbury, New York, United States) to freshen this singularized cable graft.^{1,3} The nerve-cutting guide acts as a template to help configure the fibrin-glued, cabled graft to match the size and shape of the recipient nerve stumps. This modification markedly simplifies the cable grafting procedure and allows for repair of the native nerve epineurium to the outer layer of the singular cable graft composed of epineurium and fibrin glue.

The procedure is performed under general anesthesia with tourniquet used for the nerve grafting portion of the procedure. The recipient site for grafting is carefully dissected to expose both the proximal and distal ends of the lacerated nerve. The lacerated nerve is dissected free of adhesions proximally and distally to ensure that tension-free direct repair could not be feasibly performed (→Fig. 1A). The graft nerve is then harvested in a typical fashion.

The measured gap between the lacerated proximal and distal nerve stumps is then used to guide the length of nerve graft cable preparation. One centimeter is added to the nerve gap measurement to ensure tension-free nerve grafting. The nerve graft cables are then prepared by sectioning the harvested donor nerve into multiple appropriately measured nerve graft cables. Using a nerve-cutting guide, the proximal and distal nerve stump diameters are estimated. This same-sized nerve-cutting guide is used to determine an appropriate number of nerve graft cables to be used to match the recipient nerve girth.

received
May 8, 2017
accepted after revision
July 24, 2017
published online
September 7, 2017

© 2017 Society of Indian Hand & Microsurgeons

DOI <https://doi.org/10.1055/s-0037-1606205>.
ISSN 0974-3227.

Fig. 1 Case example. (A) A 72-year-old right-handed airplane pilot was involved in an airplane crash in his private small plane and sustained polytrauma, including a right open wrist fracture dislocation and complex ulnar nerve laceration at the wrist. There was a substantial traction injury to the ulnar nerve that necessitated freshening of the lacerated ulnar nerve ends leaving a 2.5-cm segmental gap in the lacerated ulnar nerve, thus tension-free primary repair was not possible. (B) Clinical photograph of the cabled nerve grafting in situ. At 12 months postoperatively, the patient has a clearly advancing Tinel's distal to the wrist and is seeing return of sensibility in the ulnar nerve distribution (2-point discrimination now 8 mm, was > 20 mm prior to grafting) as well as gradual return of innervation to his interossei muscles.

The nerve graft cables are then placed on a nonadherent surface in the configuration planned for their repair. Nerve-cutting guides are then placed around the proximal and distal aspects of the cabled nerve graft to determine the diameter of the cabled nerve graft to allow for size match of the recipient and graft ($\rightarrow$ Fig. 2A). Fibrin glue is then sprayed on the ends of the nerve cables, gluing them together at their ends, with approximately a 5-mm cuff of fibrin glue at each end ($\rightarrow$ Fig. 2B). Care is taken to not glue the cables along their entire length to allow them to gain possible benefits of imbibition of trophic and nutritional factors from the wound bed during the healing process. After allowing the fibrin glue to dry, the same-sized nerve-cutting guide used previously in the procedure, when estimating the proximal and distal nerve stump diameters, is placed around the ends of the cabled nerve grafts. A straight razor is used to freshen the adhered cabled nerve graft ends to expose healthy fascicles to facilitate nerve re-growth after grafting ($\rightarrow$ Fig. 2C, D).

After freshening both ends of the fibrin-glued cabled nerve grafts, this graft is handled and repaired similarly to a singular nerve graft. Using microsurgical techniques, the cabled nerve graft is oriented so that the individual cabled nerves in the graft closely match the orientation of fascicles of the lacerated nerve. A 9-0 nylon suture is then used to

Fig. 2 Surgical steps of the technical modification of the cable nerve-grafting procedure. (A) Size matching the cabled nerve grafts and the recipient nerve stumps with the same-sized nerve-cutting guide. (B) Fibrin glue is application in a 5-mm cuff at each end of the cabled nerve graft. (C) Reapplication of the original nerve-cutting guide after the fibrin glue has dried, molding the cabled grafts into a circular shape, and freshening the cable graft ends with a straight razor through the cuff of dried fibrin glue. (D) Appearance of graft following freshening with healthy nerve fascicles and epineurium are exposed, and a robust mantle of fibrin glue evenly dispersed between the nerve cables and around the edges of the singular cabled nerve graft. (E) Suturing of the recipient nerve epineurium to both the fibrin glue cuff and some of the outer epineurium of the nerve cables of the singular cabled nerve graft. The fibrin glue obviates the need for the epineurium of each donor cable to be sutured to the perineurium of a size-matched recipient fascicle.

repair the epineurium of the lacerated nerve to the outer layer of the singular cabled graft composed of the epineurium of the graft cables and fibrin glue in a tension-free manner ($\rightarrow$ Figs. 2E, 1B). The repair site is then reinforced with an additional layer of fibrin glue to provide a barrier from the surrounding tissues and potential scar ingrowth.

In summary, the authors present a technique using nerve-cutting guides to aid in the placement of fibrin glue to secure the sides of the cabled nerve graft together to facilitate handling of the cabled nerve graft and to expedite repair. Freshening the graft nerve ends after the application of fibrin glue using appropriately sized nerve-cutting guides allows for excellent donor and recipient size match and epineurium-to-epineurium repair of the cabled graft to injured nerve. Though further follow-up is needed to determine long-term outcomes following this technique, early results are promising with clinical improvement seen in a similar timeframe to traditional cable nerve grafting.

Funding

None.

Conflict of Interest

None.

Acknowledgment

The authors gratefully acknowledge Cheryl R. Lawing, MD, for assistance with the medical illustrations appearing here.

References

- 1 Isaacs J. Major peripheral nerve injuries. *Hand Clin* 2013;29(03): 371–382
- 2 Birch R. Nerve repair. In: Wolfe SW, Hotchkiss RN, Pederson WC, Kozin SH, eds. *Green's Operative Hand Surgery*. 6th ed. Philadelphia, PA: Elsevier; 2011:1035–1074
- 3 Spinner RJ, Shin AY, Hebert-Blouin MN, Elhassan BT, Bishop AT. Traumatic brachial plexus injury. In: Wolfe SW, Hotchkiss RN, Pederson WC, Kozin SH, eds. *Green's Operative Hand Surgery*. 6th ed. Philadelphia, PA: Elsevier; 2011:1235–1292