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IDEAS AND INNOVATIONS

Use of poly DL-lactide-ε-caprolactone (Neurolac) conduit for enveloping traumatic neuromas

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Abstract Neuroma is a common benign neoplasm that occurs at nerve repair sites causing morbidity to the patients. There are various methods available in literature to treat neuromas and recurrence of neuromas. Poly DL-lactide-ε-caprolactone conduits are normally used to treat the nerve defects and help regeneration of the nerve. This case study describes a novel method with Neurolac conduits for the management of recurrent neuromas with promising results. This will open a new horizon for the clinicians to manage difficult and recurrent neuromas. We have described the technique with illustrations, which will help the reader to understand the steps involved in the procedure.
Level of Evidence: Level V, therapeutic study.

Keywords Poly DL-lactide-ε-caprolactone (Neurolac) conduit · Treatment · Neuroma

Introduction

Neuroma is a benign neoplasm composed chiefly of neurons and nerve fibres, usually arising from a nerve tissue. Pain radiating from the lesion to the periphery of the affected nerve is usually intermittent but may become continuous and severe. A traumatic neuroma is an unorganized bulbous or nodular mass of nerve fibres and Schwann cells produced by hyperplasia of nerve fibres and their supporting tissues after accidental or purposeful sectioning of the nerve [1, 2].

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A wide variety of surgical [3–11] and non-surgical treatments [12–18] has been documented; however, each treatment modality has its own limitations, and their outcome can be variable. Known surgical complications are functional fascicles being sacrificed and the non-functional ones repaired when performing a separational plasty. Furthermore, resection of neuromas and burying of the stumps into muscles, bones, or veins can only be used for non-functional or non-critical nerves or where repair is not suitable [5–11]. Nerve stripping an entire nerve branch results in loss of function and therefore can only be done with a sensory branch with an insignificant area of sensory supply [8]. Non-surgical treatments include local injections of alcohol or steroids with variable outcomes. Evidence has shown that steroid injections can give short-term pain relief [14], but articles by Greenfield et al. [12] and Rusmussen et al. [13] show that majority of patients still experience symptoms with a large proportion undergoing subsequent surgery. Alcohol injections have better outcomes in comparison to steroid injections [15, 16]; however, the efficacy deteriorates if used without ultrasound guidance [18]. Poly DL-lactide-ε-caprolactone (Neurolac; Polyganics, Groningen, Netherlands) is a synthetic, bioabsorbable, and transparent nerve guide used in peripheral nerve repair. The Neurolac conduit has been shown to be superior to autologous nerve grafts in the case of a short nerve gap (<1 cm) in the repair of transected peripheral nerves in animal models [19, 20]. In humans, Neurolac conduit has been shown to have comparable results to primary end-to-end anastomosis in the repair of transected peripheral nerves in the hand [21] and has also been used to reconstruct common plantar digital nerves [22]. To date, there are no published studies looking into the use of poly DL-lactide-ε-caprolactone conduit in the treatment of neuroma.

Case presentation

A 36-year-old female presented with a traumatic laceration to the dominant left hand and wrist and sustained 100 % median nerve laceration. After primary repair, she developed a symptomatic median nerve neuroma, requiring revision surgery three times before sural nerve cable grafting. Within 2 weeks of cable grafting, the neuroma recurred, and the decision was made for a Neurolac conduit to be used in prevention of neuroma synthesis.

Surgical technique

An incision was made at the previous scar on the volar aspect of the wrist. We dissected under loop magnification down to the graft site including the normal median nerve proximally and distally (Fig. 1).

The median nerve diameter was measured, and a slightly larger size nerve wrap was selected and warmed in saline of 37 °C for 1 min. This allows the solid nerve wrap to be more flexible and soft, which made cutting and nerve passage very easy as illustrated in Fig. 2. After softening the nerve wrap, it was opened along its length and wrapped around the anastomotic site. Excess material was dissected and sutured with 6/0 nylon suture material.

The length of the nerve wrap was 3 cm, and the cable graft length was 5 cm; therefore, two wraps were used to both ends. It was kept in place with another 6/0 nylon suture, which was passed through the epineurium. According to the product guidelines, two nerve wraps are inserted at both ends of the nerve graft sites as shown in Fig. 3.

The skin was closed in layers, and the forearm and hand were splinted. The patient was discharged on oral antibiotics on the following day.

Fig. 2 Warming the nerve conduits

Results

The patient was reviewed in the outpatient clinic, at 2 weeks, 6 weeks, 6 months and 1 year post procedure. She continues to describe no symptoms of pain or swelling in the forearm. The function of the median nerve (both sensory and motor) was the same in both hands in the 1-year follow-up examination.

Discussion

Neuromas continue to challenge surgeons of all specialties with no definitive treatment available. We describe the use of a synthetic, bioabsorbable nerve conduit, the Neurolac, in the treatment of a neuroma. This synthetic conduit has been used to reconstruct nerves after the resection of post-traumatic neuromas [22]; however, it has not yet been used to treat neuromas that occurred after primary repair with an autologous nerve graft. Also, in the previous study,

Fig. 1 Dissection of the median nerve

Fig. 3 Neuroma is completely covered with Neurolac conduits

neuromas were resected before the reconstruction, but in our case, the conduit was placed directly onto the primary nerve graft enveloping both the graft and the neuromas at both ends. This method resembles the standard method of separational plasty with a local fatty flap in which neuromas were separated from the skin tissue and enveloped in local fatty flaps to prevent contact with sensitive skin tissue, thus preventing pain. In our method, instead of using a local fatty flap, the synthetic conduit is used to prevent contact of the neuroma with the sensitive skin tissue. Over time, the objective is that connective tissue will form around the neuromas, and once the conduit resorbs, the neuromas will remain separated from the skin tissue. This method has an advantage over the local fatty flap in that the time to envelop the nerve with the conduit would be much shorter than using the flap. The senior author took 35 min to complete the whole procedure. Also, it eliminates the requirement of sufficient fatty tissue to be present around the length of the neuromas because the conduit is available in different sizes and lengths. The fact that the neuromas were not resected has an advantage over the separational plasty because there are no risks of sacrificing functional fascicles during resection as are possible in separational plasty.

Another method of treating neuroma is by separating fascicles by microneurolysis and redirecting regenerating axons appropriately to distal ones using electrodiagnostic testing to identify the functional fascicles, and this will naturally take a longer operating time than the method described in this article. Additionally, the use of the conduit to envelop the neuromas will eliminate the need for a suitable stump and surgical bed.

The option of resecting neuromas and burying the stumps into various tissue such as muscles, bones or vein is not a viable option for this case study as an important functional nerve is involved, the median nerve. The use of a synthetic conduit again resolves this issue as the nerve is still preserved in continuity. Similarly, stripping an entire nerve as described for the palmar cutaneous branch of the median nerve cannot be done in this case of neuromas in a main important functional median nerve. Our method of using the synthetic conduit to treat neuromas provides the dual benefits of both preserving the function of the nerve as well as eliminating the symptom of pain.

Conclusion

In conclusion, the use of a synthetic conduit poly DL-lactide-ε-caprolactone seems to be a good option in the treatment of neuromas occurring after primary repair with a nerve graft of important nerves such as the median nerve as there are many advantages over many other surgical and non-surgical treatment options. Further case studies and longer follow-ups are required to confirm our initial promising results. We hope that one day, this novel technique could be the treatment of choice of neuromas.

Conflict of Interest None

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