Resection and Use of a Processed Nerve Allograft for Reconstruction of the Tibial Nerve Following Traumatic Injury: A Case Report

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Statement of Purpose

The purpose of this case report is to present a viable option for pain relief after a traumatic tibial nerve injury

Literature Review

Isolated tibial nerve injuries are rare but can result in significant pain and co-morbidities. Historically, there have been limited options for traumatic nerve injury reconstruction until recent advances in cadaveric nerve allografts.

A case report out of India in 2015 reconstructed the tibial nerve using sural nerve autografts with favorable outcomes. The downside of using nerve autograft is creating a second donor morbidity site. Nerve allografting was first introduced in the upper extremity with regeneration of sensory and motor function of the brachial plexus in 7 of 8 patients in a study done by Elkwood et al. in 2011. Research done by Souza et al. in 2016 using processed nerve allografts for neuromas of sensory nerves of the foot and ankle showed significant improvement in pain scores and pain behavior measures in 22 patients at 15.5 months. Furthermore, Bibbo and Rodrigues-Colazzo in 2017 presented a case series of 4 patients with debilitating lower extremity neuromas successfully treated with entubulated nerve allografts with a decrease in the mean visual analog pain score from 9.5 pre-operatively to 1.25 at 26 months post-operatively. The largest study to date was done by Brooks et al. in 2012 which included 76 nerve injuries of sensory, mixed, and motor nerves. The majority of the injuries involved the upper extremity and only 3% involved the lower extremities. They calculated meaningful recovery according to several variables and found an overall meaningful recovery in 87% of repairs.

Case Study

A 24 year old male initially presented to the office in November of 2017 with complaints of significant pain to the plantar aspect of his right foot and atrophy of the plantar musculature. Patient had a laceration to the medial aspect of his lower leg approximately 10 cm above the level of the ankle joint 4 years prior. Patient underwent a laceration repair in the ER at that time and developed subsequent symptoms that have persisted since that time.

Patient had a MRI which showed signal abnormality of the flexor hallucis longus muscle and the interosseous muscles which may be indicative of denervation. The patient was also sent for an EMG/NCV which showed prolonged tibial motor latency with decreased amplitudes and conduction. The study also showed findings consistent with severe right tibial neuropathy at or above the take off to the flexor hallucis longus muscle with ongoing axonal loss. No evidence of lumbosacral radiculopathy was appreciated.

The patient underwent decompression and resection of a 70 mm section of his tibial nerve with interpositional nerve allografting with conduit placement, application of an embryonic membrane graft, and injection of BMA. The pathology report revealed disorganized nerve branches with fibrocollagenous tissue and skeletal muscle.

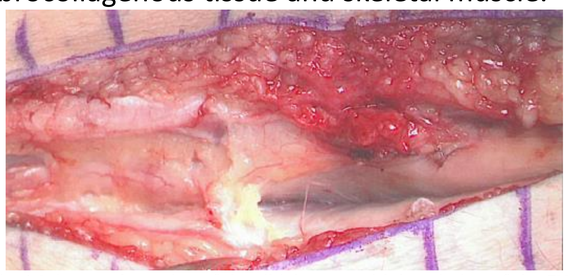

Fig. 1 Injury and scarring of the tibial nerve with herniation of the FHL muscle belly through the proximal aspect of the nerve

Fig. 2 Deliniation between the thickened and bulbous injured portion of the tibial nerve and healthy appearing nerve

Fig. 3 Transection of the proximal portion of the nerve with presence of healthy appearing nerve fascicles or "mushrooming"

Fig. 4 Resected area of diseased nerve measuring 7 cm

Fig. 5 Five mm diameter processed nerve allograft spanning the resected portion with conduit placement using 6-0 nylon suture

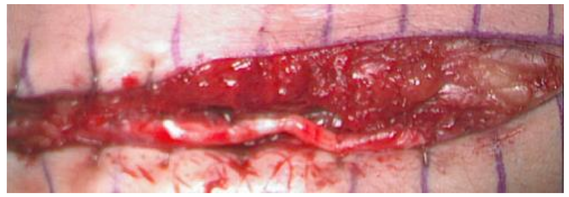

Fig. 6 Final nerve transfer with no tension on the graft

Results

Patient is 10 months post-operatively and has complete resolution of pain along the course of the tibial nerve with minimal residual numbness to the plantar aspect of the foot. Patient has continued maintenance of extrinsic muscle strength but continues to atrophy and loss of function of his intrinsic plantar musculature. Patient has been reluctant to attend physical therapy.

Discussion

Based on this case study, processed nerve allografting is a viable option for pain relief in traumatic nerve injuries of the lower extremity. Nerve autografting is associated with donor site morbidity and historically nerve allografting required immunosuppression agents to prevent host-graft reactions. With the recent increase in availability of processed and decelluarized nerve allografts on the market, the need for immunosuppression is no longer needed making nerve allograft a safe and reliable option for nerve reconstruction.

The patient has yet to regain any motor function contributing to the idea that recovery of muscle strength is variable and may require a longer time frame for recuperation. Ray and Mackinnon in their 2010 article on nerve grafting relate factors that influence recovery following a nerve injury to include time elapsed, patient age, mechanism of injury, proximity of the lesion to distal targets, and associated soft tissue or vascular injuries. As far as meaningful recovery by nerve type, gap length, time to repair, and age in Brooks et al. multicenter study, they showed the lowest rate of meaningful recovery in mixed nerves and in patients between the ages of 18-29 years old. Their largest nerve gap was 50 mm and the optimal time to repair for meaningful recovery was 3 weeks to 3 months after the injury. All of these factors could play a role in the patient's lack of muscle recovery and residual numbness.

References

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