Internal Neurolysis and Grafting of the Tibial Nerve in the Treatment of Nerve Injury due to Compression using Avance® Nerve Graft

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Presented at the 2014 Chicago Orthobiologics & Cell Regeneration Summit, University of Illinois at Chicago College of Medicine, Chicago, Illinois

Introduction

Peripheral entrapment neuropathy in the lower extremity is caused by some anatomical configuration constricting the nerve, or in the case of trauma, some anatomical disposition rendering the nerve in an inflammatory state. The nerves affected can cause intractable pain that is unresponsive to conservative treatments. Surgeons may choose to perform surgical decompression with an external neurolysis. Another option is internal neurolysis with direct repair of the sensory portion of the nerve using a nerve allograft.

AxoGuard® Nerve Connector is a commonly used in combination with nerve allograft to reinforce coaptation and promote directional axonal growth through the graft (Figure 1). Avance® Nerve Graft is an allograft tissue that provides an option for peripheral nerve reconstruction of the lower extremities (Figure 2). Structurally, the Avance nerve graft provides an epineurium to suture the graft in place, and endoneurial tubes to provide an environment for axonal growth.

Case Description

33 y/o female who has a significant PMH of HTN, Asthma, and multiple nerve procedures of the right lower extremity due to neuritis and nerve compression. Patient continues to have severe pain due to nerve entrapment and neuritis that has been confirmed with nerve conduction velocity examinations. Patient has been unresponsive to conservative treatment. Patient continues to have difficulty ambulating. Patient has failed conservative treatment and understands that this procedure is a salvage attempt to relieve the constant pain. The following nerve procedure was performed on the patient's right lower extremity.
Diagnostic Neurophysiology
Electrophysiological studies were performed following the clinical evaluation. Detailed study of pertinent nerves included proximal conduction velocities, distal latencies and evoked response amplitudes in both motor and sensory fibers.

Multiple points of stimulation were used to assess the proximal nerve segments. Proximal nerve entrapment was detected high above the tarsal ligament, at about 10 cm proximal to the medial malleolus, as evidenced by focal slowing and reduced amplitude in that particular segment. Absence of superficial peroneal responses was also found, with suggestion of proximal entrapment as well below the fibular head.

Surgical Method

1. Internal Neurolysis with interpositional Nerve Graft of Tibial Nerve" A 5cm longitudinal incision was made posterior medial to the distal tibia extending from flexor retinaculum to the level just proximal medial malleolus. The neurovascular bundle identified. The tibial nerve was noted to be enlarged and dystrophic. The proximal superficial and deep soleal slips were released with the neurovascular bundle protected and partial resection of the muscle was performed.

   -- Under operative microscopy, internal neurolysis was performed and the nerve fascicles were exposed along the area of compression. A nerve stimulator was used to identify the sensory and motor fascicles
   -- All sensory fascicles were identified and retracted away from the motor fascicles into two bundles (Figure 3). The two bundles were then ablated. The ends were resected to the level of healthy and viable nerve (Figure 4). The nerve was carefully dissected proximally until all neuro-fibrotic tissue was identified and removed.

2. Preparation and Implantation of Avance Nerve Graft- Room temperature sterile saline was applied to the product tray and the allgraft was then thawed for 10 minutes. Two 3cm portion Avance allografts were measured and introduced into the surgical field adjacent to the remaining nerve (Figure 5).

   -- The allograft was positioned and sutured to the native nerve using 8-0 nylon under operative microscopy in order to create a tensionless re-approximation. A 1mm gap between the native nerve and graft was considered adequate.

3. Wrapping of Nerve and Graft with AxoGuard® Nerve Protector: The appropriate size AxoGuard® Nerve Protector was selected based on the diameters of the native nerve and graft, so as not to constrict or compress the nerve following wrapping. A Nerve Protector of 10 mm diameter and 40 mm length was selected. The wrap was briefly hydrated in the pre-molded hydration reservoir of the packaging tray with room temperature sterile saline just prior to implantation.

   -- AxoGuard® Nerve Protector was placed around the entire allograft. The nerve protector was then circumferentially closed off using multiple vascular clips (Figure 6).
Platelet rich plasma and platelet poor plasma, which was processed from peripheral blood taken from the patient at the start of surgery, was applied along the tibial nerve. Upon completion of the procedure, the wound was thoroughly irrigated and the incision was closed in normal fashion.

Feedback on Intra-operative Handling/Conclusions
AxoGuard Nerve Protector® and Avance Nerve graft are both technically feasible for treatment in nerve trauma due to compression. These products are commonly used in protecting nerves after decompression and used in internal neurolysis with interpositional nerve graft repair. When used in combination, these products can promote axonal re-growth through peripheral nerve allografts.

Figure 1: AxoGuard® Nerve Protector

Figure 2: Avance® Nerve Graft
Figure 3: Isolation of sensory fascicles of the tibial nerve
Figure 4: Neurectomy of the sensory portion of the tibial nerve to be grafted

Figure 5: Introduction of Advance Nerve Graft to Tibial Nerve
Figure 6: Application of AxoGuard Nerve Protector to Tibial Nerve