Repair of Stump Neuroma Using AxoGuard® Nerve Protector and Avance® Nerve Graft in the Lower Extremity

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Introduction
Surgical Neurectomy of peripheral nerves may be performed under rare cases in which chronic lower extremity pain has not responded to other treatments. Neuromas, being a disorganized proliferation of nerve fascicles, are a potential complication encountered in surgical neurectomies (Figure 1). After the development of a stump neuroma, these patients may benefit from a repair with nerve allograft in a nerve to no end technique. Nerve wraps are used to cover the native nerve and graft in order to minimize the recurrence of a painful stump neuroma.

AxoGuard® Nerve Protector is a commonly used as a peripheral nerve wrap (Figure 2) that can benefit in the treatment of stump neuromas. Avance® Nerve Graft is an allograft tissue that provides an option for peripheral nerve reconstruction of the lower extremities (Figure 3). 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
The patient is a 47 year-old male with a significant past medical history of Tibial/Talar/Calcaneal fusion of the left lower extremity and complete neurotomy of the superficial peroneal nerve due to intractable pain. Patient continues to have severe pain due to nerve entrapment/Stump neuroma and neuritis. Patient has been unresponsive to conservative treatment. Patient continues to have difficulty ambulating. Symptoms experienced by the patient included painful lower extremities, burning sensation and difficulty with ambulation. Additionally, the patient has a diagnosis of equinus and tibial recurvatum resulting in the need for a distal tibial osteotomy with application of intramedullary nail. The following nerve procedure was performed on the patient’s left 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. **Identification and removal/repair of stump neuroma:** A 5cm longitudinal incision was placed at the middle 1/3 of the anterior lateral leg. Blunt dissection was performed to identify the remaining portion of the superficial peroneal nerve that was previously buried into the anterior muscular compartment.

   -- External neurolysis of the nerve was performed under loop magnification and the distal stump neuroma was transected performing a distal neurectomy of all noted proliferated tissue.
   -- The remaining nerve appeared to be healthy in appearance and without surrounding adhesions.

2. **Preparation and Implantation of Avance Nerve Graft:** Room temperature sterile saline was applied to the product tray and the allograft was then thawed for 10 minutes. A 3cm portion of Avance allograft was measured and introduced into the surgical field adjacent to the remaining nerve.

   -- 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 wraps were 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 Avance® Graft along with a portion of the native nerve. The nerve protector was then circumferentially closed off using multiple vascular clips (Figure 4)

   -- 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 painful stump neuromas thereby decreasing the chances of recurrence. 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 be used as a viable option from treatment of stump neuromas in a nerve to no end technique as described above.

Figure 2- AxoGuard® Nerve Protector

Figure 3: Advanc® Nerve Graft
Figure 4 - AxoGuard® Nerve Protector closed over nerve allograft and native nerve
Figure 1: Nerve Anatomy