Technique of the Sural Nerve Biopsy

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A sural nerve biopsy may be useful to enable the clinician to diagnose the etiology and underlying pathology of patients presenting with symptoms of a peripheral neuropathy, when no clear underlying cause has been determined with conventional assessment such as electrophysiology or quantitative sensory testing. Given the prevalence of lower extremity neurological pathology, it is surprising that few descriptions in the peer-reviewed medical literature exist on the rationale and technique for biopsy of the sural nerve. We review the usefulness of this procedure, describe the technique, and discuss the potential complications. (The Journal of Foot & Ankle Surgery 46(2):139–142, 2007)

Key words: peripheral neuropathy, sural nerve, nerve biopsy, diabetes

Peripheral neuropathy encompasses a wide range of disorders characterized by peripheral nerve dysfunction and damage. The etiology of the underlying disorder is often derived from the clinical history and neurological examination. Although there are many etiologies of peripheral neuropathy, it is important to define the underlying cause and classify into those that are potentially amenable to therapy. For example, diabetes is one of the most frequent etiologies of peripheral neuropathy, affecting at least 50% of all patients with diabetes (1, 2), yet 10% of these patients will have an etiology other than diabetes (3). If clinicians attribute all cases of peripheral neuropathy in this population to diabetes, patients with other causes, such as chronic inflammatory demyelinating neuropathy, will fail to get appropriate treatment (4). In those patients in whom the clinical history and examination suggest another cause, a thorough examination by an experienced peripheral nerve specialist is paramount.

A sural nerve biopsy is not required to diagnose most peripheral neuropathies, and conventional methods of clinical investigation such as electromyography, nerve conduction velocity, quantitative sensory and autonomic testing, and relevant laboratory assessment should be performed before embarking on this procedure (5). Thus, sural nerve biopsy should be reserved for the patient who meets the following 3 criteria: 1) when there is evidence for a disorder other than diabetic peripheral neuropathy; 2) the suspected disease is capable of causing diagnostically relevant changes in the nerve; and 3) identification of the neuropathy is likely to influence subsequent treatments (6). The sural nerve is the most commonly biopsied peripheral nerve for several reasons. It is superficial and easy to locate anatomically. It is a pure sensory and autonomic nerve, leaving no loss of motor function. Its sensory distribution is predictable and located on the dorsolateral aspect of the foot, hence permanent anesthesia in this area will not likely predispose a patient to a plantar ulcer.

Technique

The surgical technique for attaining an adequate specimen has been described in detail by Dyck et al (7). The procedure is performed as an outpatient while the patient is under local anesthetic with or without conscious sedation. The patient is positioned supine on the operating room table, with a bolster under the ipsilateral hip and the foot slightly everted to relax the sural nerve (7). No tourniquet is used, and bipolar cautery is used for hemostasis to avoid damaging the specimen or adjacent nerves.

A local anesthetic is infiltrated into the proximal lateral aspect of the lower leg, approximately 10 cm proximal to the lateral malleolus. The lower extremity is then prepped

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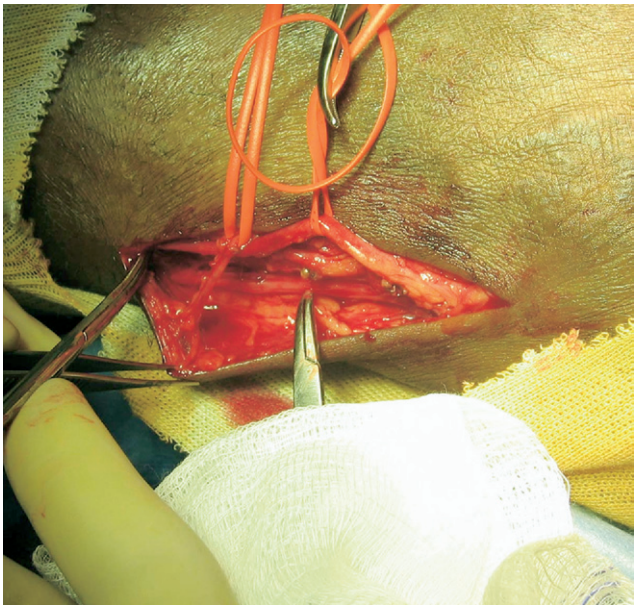

FIGURE 1 Retracting the lesser saphenous vein dorsally, enabling the surgeon to directly visualize the sural nerve.

and draped in the usual sterile fashion to the level of the knee.

A 6-cm longitudinal skin incision is made equidistant between the fibula and the Achilles' tendon, extending distally and ending just proximal to the lateral malleolus (8). The incision follows the course of the lesser saphenous vein because it is the most reliable anatomic landmark in the area (7). The sural nerve lies immediately adjacent or deep to the lesser saphenous vein at this level. The incision is then deepened until the lesser saphenous vein is identified. The vein must be retracted to visualize the sural nerve (Fig 1).

Three to 10 cm of the sural nerve is exposed (8–10). Some laboratories require longer segments of sural nerve to complete a more thorough histopathologic analysis. Some surgeons inject 0.5 to 1 mL of anesthesia directly into the substance of the nerve, proximal to the site of biopsy. We do not recommend this because it could potentially cause damage to the integrity of the nerve fibers. The decision to perform a whole or fascicular nerve biopsy is determined considering whether the underlying neuropathy may have a multifocal basis and also the severity of neuropathy. Thus, if the underlying cause is likely to result in patchy pathology and the severity is severe, then a whole nerve biopsy should be taken. If, however, it is likely to result from a diffuse cause, which involves all fascicles and the severity of neuropathy and hence sensory deficit before biopsy is mild, then a fascicular biopsy should be performed carefully under Loupe magnification (Fig 2).

A 5-0 suture is then placed through the substance of the nerve at a proximal point of the exposed nerve (7). The

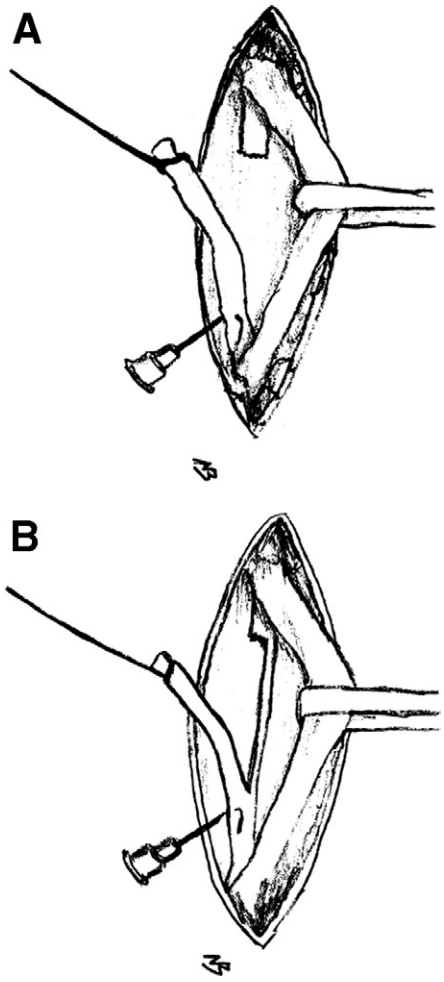

FIGURE 2 (*A*) Schematic demonstrating a whole sural nerve biopsy. (*B*) Schematic demonstrating a fascicular sural nerve biopsy.

suture is not tied; instead, it is used as a retractor. The nerve is then transected just above the suture and freed distally for approximately 3 cm. In the case of a fascicular biopsy, the nerve is also cut longitudinally at one third to one half its width with a small surgical blade. The bent hook of a 5/8″ small bore (25- to 30-gauge) needle is placed at the distal end approximately 3 cm distal to the proximal transection (Fig 3) (7). This needle acts as a weight and prevents the nerve fibers from coiling during the fixing process, thus avoiding tangential sectioning in the laboratory. The nerve is then transected distal to the weight. The specimen is never directly grasped with instrumentation and is carefully handled with the retracting suture because caution must be taken to avoid compressing the specimen. The surgeon places the first section of nerve hanging in the fixing solution by closing the cap on the retracting suture, allowing the weight of the bent needle to keep the specimen taught (Fig 4).

Each laboratory has its preference for fixing the nerve