



The value of Presurgical Ultrasonography in Chronic Median Nerve Injury of the Palm: Case Report and Review of the Literature

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Background: The prevalent approach for localizing and assessing the severity of traumatic peripheral nerve injuries involves clinical evaluation and electrodiagnostic studies. Ultrasonographic examination of the median nerve in patients with carpal tunnel syndrome (CTS) has been proposed as a useful alternative to electromyography (EMG) and nerve conduction velocity (NCV) studies in diagnosing CTS. **Case presentation:** A 22-year-old man developed numbness and cold intolerance over the left thumb, index and middle fingers after a penetrating injury accident to the left palm caused by a broken glass 7 years before. Primary wound closure was done at a private clinic. High-resolution ultrasonography (Philips HDI 5000 SonoCT Germany) with a 7.0-12 MHz broadband linear probe was used to evaluate the condition of the injured median nerve. **Results:** Ultrasonography showed complete transection of the median nerve, the presence of a neuroma and the gap in the nerve. Preoperatively, the surgical plans, such as neuroma excision and necessity for nerve grafting were explained to the patient and his family. **Conclusion:** Our results indicate that preoperative high-resolution ultrasonography is informative in the evaluation of chronic peripheral nerve injuries and can show the type of injury. It is also useful in the planning of surgical intervention.

Key words: ultrasonography; median nerve injury; old penetrating injury

INTRODUCTION

Peripheral nerve injuries occur from a variety of causes in clinical practice. Penetrating, oppressive, sharp and hard objects such as knives, glass and missiles are frequent causes of nerve injuries and the prevalence among trauma patients is about 2.8%.¹ The current approach for diagnosing the pathology involves the history, physical and neurological examination and electrodiagnostic tests (nerve conduction and electromyography).²⁻⁶ Electrodiagnostic tests have been defined as the gold standard in the diagnosis, localization and description of a nerve lesion. However, these tests might not be able to give clear information about the type of injury, visualiza-

tion of nerve stumps, diagnosing the presence or absence of a neuroma and evaluation of excessive perilesional scar tissue formation for orientation and planning of surgical intervention. The physician needs a reliable, cheap, practical and readily available diagnostic method in clinical practice. In this case report we evaluated the feasibility of preoperative ultrasonographic examination of the left palm in the localization and description of chronic median nerve injury.

CASE REPORT

A 22-year-old man sustained a penetrating injury accident of the left palm from a broken glass and primary wound closure was undertaken at a private clinic 7 years ago. Since then, he had noticed a loss of sensation to pinpricks over the left thumb, index and middle fingers, a progressively excruciating tingle in the left palm following light banging, and cold intolerance of left thumb, index and middle fingers. With these persistent symptoms, he visited our plastic surgery clinic. A nerve conduction study showed median nerve neuropathy. After admission, ultrasonography (Philips HDI 5000 SonoCT, Germany) with a 7.0-12 MHz broadband linear probe showed a gap of the median nerve with formation of a neuroma

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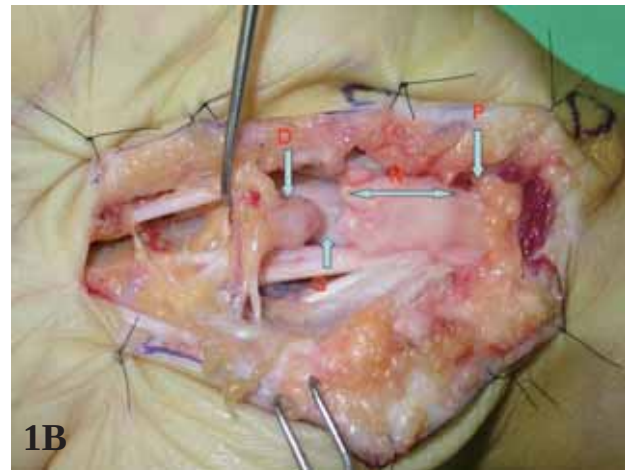


Fig. 1 (1A). Ultrasonographic image depicting a transection (G) of the median nerve in the left palm. Proximal stump (P), distal nerve stump (D), neuroma (N). (1B). Intraoperative photography showing the complete nerve gap (G), distal (D) and proximal (P) nerve stumps and neuroma formation (N).

(Fig. 1A). Surgical exploration revealed complete severance of the median nerve and a neuroma at the proximal stump (Fig. 1B). The patient underwent excision of the neuroma, neurolysis and then repair of median nerve with sural nerve grafting (Fig. 2 A, B). The postoperative course was uneventful. During a 1-year follow up, the aforementioned symptoms improved progressively and the average static two-point discrimination of the fingers involved was 10 mm.

DISCUSSION

Neurological examination and electrodiagnostic tests are the gold standards in the diagnosis of peripheral nerve lesions and for making decisions about the selection of treatment modality.^{3,7,8} The limitations of these methods for assessing the location and type of peripheral nerve injury have led to explorations of alternative techniques, such as imaging. With the advent of higher resolution imaging and better image reconstruction, the ability to identify and map peripheral nerves in both the upper and lower extremities is now well described.^{9,10} High-resolution ultrasonography, which is useful in the evaluation of compression neuropathies,^{11,12} has been used successfully to evaluate 14 cases of traumatic peripheral nerve injury preoperatively.² It revealed axonal swelling, neuroma formation, complete nerve transection prior to surgery and improvement of subsequent surgical planning.² One study showed that high-resolution ultrasound was able to identify transected nerves in the upper extremity with

89% sensitivity and 95% specificity in fresh cadavers.¹ Some studies have evaluated the benefits and feasibility of presurgical and intraoperative ultrasonographic examination of the upper and lower extremities in the localization and description of injury, evaluation of nerve stumps, diagnosing a stump neuroma, determination of perilesional scar formation, detecting foreign missiles in and around the injury site and in assessing the severity of the lesion.^{13,14}

Other imaging modalities, such as computerized tomography (CT) and magnetic resonance imaging (MRI) can also outline peripheral nerves. MRI has higher capability than CT for this purpose and has potentially greater resolution than ultrasound.¹⁵ However, ultrasonography currently has the advantages of being a faster, more cost-effective, radiation-free image processing technique. It also offers portability, continuous scanning with no skipped sections, superior spatial resolution for a more dynamic study and real-time imaging. Furthermore it can be used on claustrophobic patients. The limitations of the application of high-resolution ultrasonography in the evaluation of the peripheral nerves are its operator dependence and its relatively long learning curve.

When surgical intervention should be performed on injured peripheral nerves is a challenging issue in the practice of peripheral nerve surgery. There is no consensus in the timing of surgical exploration.⁷ Some authors prefer to delay for up to 3 weeks after traumatic injury. However, others suggest early surgical exploration with repair of the injured segment as soon as possible.⁷ The



Fig. 2 (2A). Intraoperative photography following excision of the neuroma showing a 3 cm gap (G) between the distal and proximal nerve stump. (2B). Intraoperative photography showing the median nerve being repaired with a sural nerve graft.

decision for surgical intervention or conservative treatment is generally based on neurological examinations and electrodiagnostic studies.^{7,8}

The main objectives of authors who suggest late surgical intervention are the possibility of spontaneous nerve repair and the need to wait for reliable information from electrodiagnostic studies. In the early stage of an injury (within 3 weeks), electrodiagnostic studies might not provide reliable information about the injury. However, even if electrodiagnostic studies are performed up to 3 weeks after an injury, it can be difficult to obtain objective information about the pathomorphological status of the nerve. This term covers the continuity, architecture, shape, calibration and integrity of a nerve segment.

Ultrasonographic neuroexamination is a helpful diagnostic tool in both acute and chronic cases of peripheral nerve injury. In acute cases, presurgical ultrasound-assisted neuroexamination is useful in diagnosing the continuity of an injured nerve, the determination of a perineural hematoma and definition of the type of injury. In chronic cases, presurgical and/or intraoperative ultrasonographic neuroexaminations applied to electrodiagnostic studies are extremely helpful in the definition of the type of injury, in determining the position of the nerve stumps, in the diagnosis of a stump neuroma, in detecting excessive perilesional scar formation and for precise localization of the injured site. Sonographic neuroexaminations can also enhance the orientation of a surgeon to the operative field during the course of surgical intervention, especially in chronic cases.²

In the present patient with a chronic case of median

nerve injury, preoperative ultrasonography accurately identified the complete severance of the median nerve and the presence of a neuroma. Subsequently, the neuroma was excised and repair of the median nerve was performed using sural nerve grafting.

In conclusion, a meticulous scanning technique with high-resolution sonography can facilitate the identification of nerve stumps. It also assists in diagnosing a stump neuroma, in determining perilesional scar formation preoperatively and thus in aiding the design of a surgical plan. High-resolution ultrasonography for chronic median nerve injuries is a cheap, simple and readily available diagnostic tool for clinical practice.

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