Predicting Recovery from Peripheral Nerve Trauma

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KEYWORDS

• Electrodiagnosis • Prognosis • Focal neuropathy • Traumatic neuropathy
• Outcome

KEY POINTS

- Prognosis of focal nerve injuries is an important piece of information for those managing these types of patients.
- By providing an estimate of outcome from a nerve injury, one allows the treating physician to make an informed recommendation regarding treatment options.
- For those with a poor prognosis for spontaneous recovery, tendon transfers may be a good early option or, in some cases, early nerve transfers or grafting may be indicated.
- A patient with a good prognosis for recovery may be better treated conservatively, because spontaneous recovery is usually better than surgical treatment.

INTRODUCTION

The prognosis for focal nerve injuries is an important piece of information for those managing these types of patients. By providing an estimate of outcome from a nerve injury, one allows the treating physician to make an informed recommendation regarding treatment options. For those with a poor prognosis for spontaneous recovery, tendon transfers may be a good early option or, in some cases, early nerve transfers or grafting may be indicated. In contrast, a patient with a good prognosis for recovery may be better treated conservatively, because spontaneous recovery is usually better than surgical treatment.

In this article, we discuss the types of nerve injuries that have better prognoses, review which electrodiagnostic measures are generally useful for predicting outcome, and summarize the information available for focal injuries of the commonly affected and studied nerves so that nerve-specific information can be provided. We also discuss the challenges in using electrodiagnostic data to predict prognosis.

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Abbreviations	
BR	Brachioradialis
CFN	Common fibular nerve
CMAP	Compound muscle action potential
CTS	Carpal tunnel syndrome
EDB	Extensor digitorum brevis
MCP	Metacarpophalangeal
MUAP	Motor unit action potential
PACN	Posterior antebrachial cutaneous nerve
ROM	Range of motion
SNAP	Sensory nerve action potential
TA	Tibialis anterior

GRADING OF TRAUMATIC NERVE INJURY

Traumatic peripheral nerve injuries can be classified according to the degree of disruption of axons and their supporting structures.[1] This classification represents a significant determinant of outcome. Seddon defined 3 grades of classification: (1) neurapraxia, (2) axonotmesis, and (3) neurotmesis.[2]

Neurapraxia is a primarily demyelinating injury that has a good prognosis, because most patients experience recovery within 2 to 3 months as remyelination occurs and conduction block resolves.[2] In axonotmesis, there is disruption of axons with at least partial preservation of supporting structures, such as the perineurium (surrounding fascicles) or epineurium (the outer covering of the nerve). Axonotmetic injuries have variable prognosis depending on the ability of axons to regrow. Nerve injuries with more severe disruption of supporting elements of the nerve will have a lower chance of recovery than those with minimal disruption.[3] In injuries with extensive disruption of the fascicular structure and local scarring and fibrosis, there is a lesser chance of axons growing through the region of injury and reaching their end organs on the other side. Similarly, neuroma formation at the site of injury makes it unlikely that axons will make it through the neuroma and across the injury site to fulfill their destined function. Finally in neurotmesis, there is complete disruption of both the axons and the supporting structures of the nerve and there is little chance of recovery without surgical intervention.

DEGREE OF DEMYELINATION

The extent of demyelination may also influence recovery, but this seems to have less impact than the degree of axon loss. Severe disruption of myelin can certainly produce conduction block and clinical deficits. But after a loss of myelin, Schwann cells generally have the capacity to remyelinate demyelinated areas of the nerve, and conduction improves. The morphology and function of the myelin will not be the same as before the injury,[4] and slowed conduction velocity may persist.[5] Nevertheless, because of the capacity for remyelination, in general neurapraxic traumatic nerve injury has a good prognosis, with the majority of patients experiencing substantial recovery within 2 to 3 months.

EXTENT OF AXON LOSS

The degree of axon loss has a large impact on prognosis. Nerve injuries with minimal axon loss generally have a better prognosis. When some motor axons are spared, fortunately they have the capacity to reinnervate some denervated muscle fibers by distal axon sprouting. Thus, this process can accommodate relatively mild degrees of axon