

DIAGNOSIS OF MULTIPLE SENSORY NEUROPATHIES VIA ELECTRODIAGNOSTIC EXAMINATION FOLLOWING A SMALL ANIMAL BITE

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ABSTRACT

Objective: To discuss a case of traumatically-induced sensory neuropathy and neurotmetic injury due to a small animal bite. Terminology associated with neuronal injury is reviewed. Accompanying electrodiagnostic studies are also discussed.

Clinical Features: A 26-year old man was referred by an orthopedic surgeon for electrodiagnostic evaluation following an exotic animal bite to his right arm, which occurred approximately 2 months prior to the examination. His symptoms included right distal anterolateral “scraping and burning” arm pain. The pain was reported as constant and varied from 1-6/10 in severity, and radiated into the lateral forearm and dorsal aspects of the 1st and 2nd digits of his hand, with intermittent paresthesia. Heat and sunlight provoked pain, and no palliative measures were reported. The injury was a closed lesion. Abnormal sensory nerve action potentials (SNAPs) of the both the lateral antebrachial cutaneous and superficial radial nerves on the right were obtained, characterized by ‘no response’. A decreased amplitude in the left distal median motor nerve was also present, which appears consistent with an incidental finding of a left sided Martin-Gruber anastomosis (anomalous innervation).

Intervention and Outcome: A comprehensive electrodiagnostic evaluation was performed, including nerve conduction studies of sensory and motor nerves, F-Wave studies, and both surface and Needle EMG examinations. The patient’s injury caused abnormal distal sensory latencies and amplitudes of both the right lateral antebrachial cutaneous and superficial radial nerves. Electrophysiological evidence was consistent with severe sensory neuropathies of the lateral antebrachial cutaneous and superficial radial nerves on the right. These findings are consistent with neurotmetic lesions.

Conclusions: Clinical correlation was advised, and the patient was sent back to the referring physician. (*J Contemporary Chiropr 2021;4:8-11*)

Key Indexing Terms: Electrodiagnosis; Antebrachial Cutaneous Sensory Nerve; Radial Nerve; Sensory Neuropathy; Neuropathy; Trauma; Neurotmesis

INTRODUCTION

The term neuropathy, used in its contemporary form, encompasses a wide-range of disorders, both peripheral and otherwise. (1) While there are many causes, this paper discusses one due to trauma from an animal bite. A 26-year old man was referred for electrodiagnostic evaluation of arm pain approximately 2 months after being bitten by a small animal. While consent was obtained from the patient for publication, in deference the unique nature of the injury, we have made a choice to remove the specific species of animal from the case to better maintain patient anonymity. Seddon’s classification



Figure 1. The view of the patient's healing bite wound. The initial injury occurred almost 2 months prior to the electrodiagnostic evaluation.

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of peripheral nerve injury describes 3 types that can occur: neuropraxia (Type 1), axonotmesis (Type 2), and neurotmesis (Type 3). The hallmarks of neurotmetic disease include damage to all of the layers of the nerve, including the axons, endoneurium, perineurium, and epineurium. (2,3) Additionally, EMG examination of patients with this classification of neuronal injury shows acute denervation, with nerve deficits that may remain for a year or more. Regeneration of neurotmetic damage may occur in a disorganized fashion and requires surgical repair. (4)

While there are many cases of general neuropathy in the literature, this case demonstrates an interesting pathogenesis of the condition while highlighting how such a condition is objectively diagnosed.

CASE REPORT

History

A 26-year-old man was referred to a chiropractic neurologist by his attending orthopedic surgeon for electrodiagnostic studies to evaluate a suspected peripheral neuropathy following a small animal bite, as well to determine the etiology of his complaints. (Figure 1) The studies referenced in here were performed 2 months after the traumatic incident occurred. The patient's chief complaint was pain and paresthesia of the right upper extremity. The pain began at the right distal anterolateral aspect of the arm and had a "scraping and burning" quality. It was constantly present and varied between 1-6/10 in severity. There was radiation extending into the lateral forearm and dorsal aspects of the 1st and 2nd digits of the hand. Paresthesia was also identified along the same distribution. Heat and sunlight increased symptoms and nothing seemed to help it get better.

conduction studies with needle electromyography were performed to identify the suspected pathology.

Physical Examination

Peripheral sensitivity testing, using a Wartenburg pinwheel, was graded as equal in character bilaterally throughout the C5-T1 and L1-S1 dermatomes of the upper and lower extremities, with the exception of altered sensation noted on the right upper extremity resulting in sustained objective paresthesia overlying the right lateral antebrachial cutaneous and superficial radial nerve distributions. The upper and lower limbs showed normal differentiation between sharp vs. dull, distinction between hot and cold, vibratory perception, joint position and graphesthesia. There was no astereognosis of the hands.

Visual inspection of the hands was negative for gross atrophy of the thenar eminences, bilaterally. Two-point discrimination remained intact both statically and with motion using a 7mm setting on an aesthesiometer. Light touch/pressure was intact as assessed with a 5.07 (10g) Semmes-Weinstein monofilament. Phalen's test, Tinel's Tap test and wrist flexion with manual median nerve compression were all negative bilaterally for median, ulnar, and superficial radial nerve neuropathies. Manual muscle testing of the right abductor pollicis and opponens pollicis muscles, which are innervated by the median nerve, was performed, and were graded at a 5/5.

Electrodiagnostic Studies

Conventional motor and sensory nerve conduction studies with late responses were performed in order to evaluate for peripheral neuropathy. Needle EMG examination of selected upper limb muscles was performed to evaluate for denervation secondary to

Table 1. The results of the performed Antidromic Sensory portion of the electrodiagnostic studies. Both the right lateral antebrachial cutaneous nerve and the right radial sensory branch demonstrate complete lack of findings consistent with neurotmesis injury

Nerve Conduction Studies											
Anti Sensory Summary Table											
Stim Site	NR	Peak (ms)	Norm Peak (ms)	P-T Amp (µV)	Norm P-T Amp	Site1	Site2	Delta-0 (ms)	Dist (cm)	Vel (m/s)	Norm Vel (m/s)
Left Lat Ante Brach Cutan Anti Sensory (Lat Forearm) 35.4°C											
Lat Biceps		4.2	<3.0	29.3	>10.0	Lat Biceps	Lat Forearm	3.2	12.0	38T	>55.0
Right Lat Ante Brach Cutan Anti Sensory (Lat Forearm) 35.4°C											
Lat Biceps	NR		<3.0		>10.0	Lat Biceps	Lat Forearm		12.0		>55.0
Left Median Anti Sensory (2nd Digit) 35.4°C											
Wrist		3.2	<3.6	49.2	>10.0	Wrist	2nd Digit	2.3	12.0	52T	>50.0
Right Median Anti Sensory (2nd Digit) 35.4°C											
Wrist		2.7	<3.6	43.9	>10.0	Wrist	2nd Digit	2.0	12.0	60T	>50.0
Left Radial Anti Sensory (Base 1st Digit) 35.4°C											
Wrist		2.6	<3.1	37.8	>15.0	Wrist	Base 1st Digit	2.0	12.0	60T	>50.0
Right Radial Anti Sensory (Base 1st Digit) 35.4°C											
Wrist	NR		<3.1		>15.0	Wrist	Base 1st Digit		12.0		>50.0
Left Ulnar Anti Sensory (5th Digit) 35.4°C											
Wrist		3.1	<3.7	31.7	>15.0	Wrist	5th Digit	2.4	12.0	50T	>50.0
Right Ulnar Anti Sensory (5th Digit) 35.4°C											
Wrist		3.0	<3.7	31.5	>15.0	Wrist	5th Digit	2.3	12.0	52T	>50.0

radiculopathy. All procedures were performed using a Cadwell Sierra Summit electromyographic instrument. (Kennewick, WA) The needle examination was performed using 28-gauge disposable monopolar needle electrode. The relevant EMG findings are included in Table 1.

Interventions and Outcomes

The chiropractic physician conducting the electrodiagnostic studies in this case was not a direct part of the patient's treatment team. This draws attention to the fact that specialists conducting diagnostic testing may not have the opportunity to follow-up with the patient or become directly involved in the treatment plan and/or case management. While we do not know the specific outcomes for this patient, standard interventions for neurotmetic injury have been included as a reference for readers that may have the opportunity to manage these types of injury within their practice.

DISCUSSION

While there is a plethora of information on peripheral nerve injury, treatments that ensure full recovery are limited. (5) This may be due to both the varied fiber types and somatotopic organization within each peripheral nerve fascicle. (6) Unfortunately, sudden recovery of functional deficits is unlikely without surgical involvement. (7) As an objective measure of motor axon loss, needle electromyography has the highest sensitivity.

Needle electromyography (EMG) is a diagnostic procedure that assesses the health and integrity of motor units: the motor neurons and the muscle fibers it innervates. A needle is inserted into the muscle belly and the electrical signals are analyzed both during contraction and at rest. Assessment is imperative to confirm or exclude other differential diagnoses, defining the pathophysiology, and characterizing severity and prognosis. All examined muscles showed no evidence of electrical instability. These findings confirmed that the patient's injury was superficial, affecting only sensory nerves.

Current research indicates that sharp nerve transections usually undergo surgical repair within 3 days. (6,8) Although the patient here delayed care, it is important to note that the speed at which the severity of the lesion can be assessed is important in ensuring the best possible prognosis.

Our report details a unique case of a superficial injury causing persistent neurological deficits 2 months after the initial presentation.

Since the patient came solely for electrodiagnostic workup, the results were forwarded to the referring orthopedic surgeon for final diagnosis, factoring in the

clinical correlations. The objective findings provided by the electrodiagnostic studies indicate a diagnosis of neurotmetic injury of both the right lateral antebrachial cutaneous and superficial radial nerves.

Limitations

As this is a case study, the individual findings of this case may not be able to be generalized to other patients and/or clinical situations.

CONCLUSION

This case suggests that although traumas may appear to be healing superficially, there may be long-term neurological consequences and/or sequela of animal bite injury. Clinicians that may encounter similar case presentations within their practices as well as their patients may benefit from electrodiagnostic testing to determine the exact etiology of the remaining symptoms. Timing is crucial in regard to surgical repair of injuries of this type. To prevent nerve degeneration, the transected endoneurial tubes must regain contact with the newly generated axonal tissue within 18 months to 2 years post-injury. (7)

This case is interesting for a multitude of reasons, including the unique nature of the presenting complaint as well as the involvement of a chiropractic neurologist and electromyographer as part of the diagnostic team. Although situations like this will not be seen frequently within a chiropractic practice, it is our hope that others may benefit from the information presented here. Further, the inclusion of referral to a chiropractic neurologist for full diagnostic workup highlights the diverse ways that members of our profession can contribute to a multidisciplinary patient-centered care team.

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