Medical Policy

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Title: Electromyography and Nerve Conduction Studies

Related policy:	*Automated Point-of-Care Nerve Conduction Tests*

Professional
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Populations	Interventions	Comparators	Outcomes
Individuals: • With suspected peripheral neuropathy or myopathy	Interventions of interest are: • Electrodiagnostic assessment including electromyography and nerve conduction studies	Comparators of interest are: • Clinical diagnostic workup without electrodiagnostic testing	Relevant outcomes include: • Test accuracy • Symptoms • Functional outcomes • Quality of life

DESCRIPTION

Electromyography (EMG) and nerve conduction studies (NCS), also collectively known as an electrodiagnostic assessment, evaluate the electrical functioning of muscles and peripheral nerves. These tests are diagnostic aids for the evaluation of myopathy and peripheral neuropathy by identifying, localizing, and characterizing electrical abnormalities in the skeletal muscles and peripheral nerves.

Objective

The objective of this evidence review is to evaluate whether electromyography and nerve conduction study improves the net health outcome in patients suspected peripheral neuropathy and/or myopathy.

Background

Electrodiagnostic Assessment

Electromyography (EMG) and nerve conduction study (NCS) are used as adjuncts to clinical evaluation of myopathy and peripheral neuropathy.[1,] These tests intend to evaluate the integrity and electrical function of muscles and peripheral nerves. They are performed when there is clinical suspicion for a myopathic or neuropathic process and when clinical examination and standard laboratory testing cannot make a definitive diagnosis.

Test results do not generally provide a specific diagnosis. Rather, they provide additional information that assists physicians in characterizing a clinical syndrome. EMG/NCS may be useful when there is no clear etiology when symptoms are severe or rapidly progressing, or when symptoms are atypical (eg, asymmetrical, acute onset, or appearing to be autonomic).

According to the American Association of Neuromuscular & Electrodiagnostic Medicine (1999), electrodiagnostic assessment has the following goals.[2,]

1. "Identify normal and abnormal nerve, muscle, motor or sensory neuron, and NMJ [neuromuscular junction] functioning.
2. Localize region(s) of abnormal function.
3. Define the type of abnormal function.
4. Determine the distribution of abnormalities.
5. Determine the severity of abnormalities.
6. Estimate the date of a specific nerve injury.
7. Estimate the duration of the disease.
8. Determine the progression of abnormalities or recovery from abnormal function.
9. Aid in diagnosis and prognosis of the disease.
10. Aid in selecting treatment options.
11. Aid in following response to treatment by providing objective evidence of change in NM [neuromuscular] function.
12. Localize correct locations for injections of intramuscular agents…."

Components of the electrodiagnostic exam may include needle EMG, NCS, repetitive nerve stimulation study, somatosensory evoked potentials, and blink reflexes.

ELECTROMYOGRAPHY

Needle Electromyography

An EMG needle electrode is inserted into selected muscles, chosen by the examining physician depending on the differential diagnosis and other information available during the exam.[2,] The response of the muscle to electrical stimulation is recorded. Three components are evaluated:

observation at rest, action potential with minimal voluntary contraction, and action potential with maximum contraction.[3,]

Single Fiber Electromyography

In single-fiber EMG, a needle electrode records the response of a single muscle fiber. This test can evaluate "jitter," which is defined as the variability in the time between activation of the nerve and generation of the muscle action potential. Single fiber EMG can also measure fiber density, which is defined as the mean number of muscle fibers for 1 motor unit.

Nerve Conduction Study

In NCS, both motor and sensory nerve conduction are assessed. For motor conduction, electrical stimuli are delivered along various points on the nerve, and the electrical response is recorded from the appropriate muscle. For sensory conduction, electrical stimuli are delivered to 1 point on the nerve, and the response is recorded at a distal point on the nerve. Parameters recorded include velocity, amplitude, latency, and configuration.[2,]

Late Wave Responses

Late waves are a complement to the basic NCS and evaluate the functioning of the proximal segment of peripheral nerves, such as the nerve root and the anterior horn cells. There are 2 types of late responses: the H-reflex and the F wave.

The H-reflex is elicited by stimulating the posterior tibial nerve and measuring the response in the gastrocnemius muscle. It is analogous to the ankle reflex and can be prolonged by radiculopathy at S1 or by peripheral neuropathy.[3,]

The F wave is assessed by supramaximal stimulation of the distal nerve and can help estimate the conduction velocity in the proximal portion of the nerve.[3,] This will provide information on the presence of proximal nerve abnormalities, such as radiculopathy or plexopathy.

Repetitive Nerve Stimulation

Repetitive nerve stimulation studies evaluate the integrity and function of the neuromuscular junction. The test involves stimulating a nerve repetitively at variable rates and recording the response of the corresponding muscle(s).[3,] Disorders of the neuromuscular junction will show a diminished muscular response to repetitive stimulation.

Somatosensory Evoked Potentials

Somatosensory evoked potentials evaluate nerve conduction in various sensory fibers of both the peripheral and central nervous system and test the integrity and function of these nerve pathways.[2,] They are typically used to assess nerve conduction in the spinal cord and other central pathways that cannot be assessed by standard NCS.

Blink Reflexes

The blink reflexes, which are analogs of the corneal reflex, are evaluated by stimulating the orbicularis oculi muscle at the lower eyelid. They are used to localize lesions in the fifth or seventh cranial nerves.[2,]

Differential Diagnosis

The specific components of an individual test are not standardized. Rather, a differential diagnosis is developed by the treating physician, and/or the clinician performing the test, and the specific components of the exam are determined by the disorders being considered in the

differential. Also, the differential diagnosis may be modified during the exam to reflect initial findings, and this may also influence the specific components included in the final analysis.[2,]

Regulatory Status

EMG/NCS measure nerve and muscle function and may be indicated when evaluating limb pain, weakness related to possible spinal nerve compression, or other neurologic injury or disorder. A number of electromyographic devices have received marketing clearance from the U.S. Food and Drug Administration. Several devices are listed in Table 1.

Table 1. Electromyographic Devices Approved by FDA

Device	Manufacturer	FDA Clearance	510(k) No.	FDA Product Code
NuVasive® NVM5 System	NuVasive	2011	K112718	ETN
CERSR® Electromyography System	SpineMatrix	2011	K110048	IKN
CareFusion Nicolet® EDX	CareFusion 209	2012	K120979	GWF
Physical Monitoring Registration Unit-S (PMRU-S)	Oktx	2013	K123902	IKN
MyoVision 3G Wirefree™ System	Precision Biometrics	2013	K123399	IKN
Neuro Omega™ System	Alpha Omega Engineering	2013	K123796	GZL
EPAD™	SafeOp Surgical	2014	K132616	GWF
Sierra Summit, Sierra Ascent	Cadwell Industries	2017	K162383	IKN, GWF
EPAD 2™	SafeOp Surgical	2019	K182542	GWF, IKN
Mediracer® NCS	Mediracer	2019	K190536	JXE, IKN

FDA: U.S. Food and Drug Administration.

POLICY

1. Electromyography and Nerve Conduction Studies are **medically necessary** as referenced in the following charts:

   Chart A - Type of Study / Maximum Number of Studies
   Chart B - Nerve Conduction Studies, and
   Chart C - Maximum Number of Studies for Additional Codes

Chart A

Type of Study / Maximum Number of Studies*			
Indication	**Limbs Studies by Needle EMG (95860-95864, 95867-95870, 95885-95887)**	**Nerve Conduction Studies (Total Nerves Studied 95907-95913)**	**Neuromuscular Junction Testing (Repetitive Stimulation, 95973)**
Carpal Tunnel (unilateral)	1	7	
Carpal Tunnel (bilateral)	2	10	
Radiculopathy	2	7	
Mononeuropathy	1	8	
Polyneuropathy/ Mononeuropathy Multiplex	3	10	
Myopathy	2	4	2
Motor Neuronopathy (eg, ALS)	4	6	2
Plexopathy	2	12	
Neuromuscular Junction	2	4	3
Tarsal Tunnel Syndrome (unilateral)	1	8	
Tarsal Tunnel Syndrome (bilateral)	2	11	
Weakness, Fatigue, Cramps, or Twitching (focal)	2	7	2
Weakness, Fatigue, Cramps, or Twitching (general)	4	8	2
Pain, Numbness, or Tingling (unilateral)	1	9	
Pain, Numbness, or Tingling (bilateral)	2	12	

*Portions of the above chart adopted from the 2020 Current Procedural Terminology© American Medical Association publication – Appendix J.

Chart B

Nerve Conduction Studies		
Codes	**Nomenclature**	**CPT Instructions**
95907	Nerve conduction studies; 1-2 studies	For the purposes of coding, a single conduction study is defined as a sensory conduction test, a motor conduction test with or without an F wave test, or an H-reflex test. Each type of study (sensory, motor with or without F wave, H-reflex) for each nerve includes all orthodromic and antidromic impulses associated with that nerve and constitutes a distinct study when determining the number of studies in each grouping (e.g. 1-2 or 3-4 nerve conduction studies). Each type of nerve conduction study is counted only once when multiple sites* on the same nerve are
95908	Nerve conduction studies; 3-4 studies	
95909	Nerve conduction studies; 5-6 studies	
95910	Nerve conduction studies; 7-8 studies	
95911	Nerve conduction studies; 9-10 studies	

Nerve Conduction Studies		
Codes	**Nomenclature**	**CPT Instructions**
95912	Nerve conduction studies; 11-12 studies	stimulated or recorded. The number of these separate tests should be added to determine which code to use. *CPT Appendix J lists the nerves that can be tested and coded under nerve conduction study codes. The branches of each nerve are also listed, but the unit of service is limited to the nerve and not the branches.
95913	Nerve conduction studies; 13 or more studies	

Chart C

Maximum Number of Studies for Additional Codes			
Codes	**Units**	**Codes**	**Units**
95865	1	95925	1
95866	1	95926	1
95872	1	95927	1
95885	▪ 1 per extremity ▪ also can be used for muscles on the thorax or abdomen (unilateral or bilateral)	95933	2
95886	1 per extremity	95938	1
95887	1 per day	95939	1

2. Surface EMG (SEMG) (S3900) is **experimental / investigational**. This refers to a recording of electrophysiologic signals from skeletal muscles. The recording is made using electrodes placed on the surface of the skin overlying the muscle, and consists of motor unit action potential (MUAP) discharges. The electrical activity is only observed when the muscle is activated. It does not include any monitoring of externally stimulated muscle activity as occurs in nerve conduction studies, H reflexes, F waves, and other tests. There are no indications for the use of SEMG in the diagnosis and treatment of disorders of nerve or muscle.

3. Current perception threshold (CPT) / sensory nerve conduction threshold (SNCT) (G0255) is **experimental / investigational**. This test diagnoses sensory neurological impairments caused by various pathological conditions or toxic substance exposures. It is a noninvasive test that uses transcutaneous electrical stimulus to evoke a sensation. CPT/SNCT methods quantitate the level of sensory deficit by comparing current output to the nerve conduction threshold, but has the problem, however, that significant variability occurs associated with changing skin resistance.

Policy Guidelines

1. Nerves Tested Must be Limited - CPT includes a reminder that has been included in CPT since 2000: "Nerves tested must be limited to the specific nerves needed for the particular clinical question being investigated." Appendix J includes a chart outlining the maximum number of studies expected for typical neurological complaints. CPT 2013 also includes additional wording that the report must be prepared on-site by the examiner. Electromyography is often conducted at the same session as nerve conduction studies CPT 2012 added codes specifically for these situations: add-on codes 95996, 95886, and 95887. These codes will be added to the new nerve conduction study codes when applicable.[OR3]

2. Testing should be performed using EDX equipment that provides assessment of all parameters of the recorded signals. Studies performed with devices designed only for "screening purposes" rather than diagnosis, are not medically necessary.

3. Like the Wisconsin Physicians Service (WPS), Blue Cross and Blue Shield of Kansas expects healthcare professionals who perform electrodiagnostic (ED) testing will be appropriately trained and/or credentialed, either by a formal residency/fellowship program, certification by a nationally recognized organization, or by an accredited post-graduate training course covering anatomy, neurophysiology and forms of electrodiagnostics (including both NCS and EMG), in order to provide the proper testing and assessment of the patient's condition, and appropriate safety measures. It would be highly unlikely that this training and/or credentialing is possessed by providers other than Neurologists, or Physical Medicine & Rehabilitation physicians.

4. The electrodiagnostic evaluation is an extension of the neurologic portion of the physical examination. Both require a detailed knowledge of a patient and his/her disease. Training in the performance of electrodiagnostic procedures in isolation of knowledge about clinical diagnostic and management aspects of neuromuscular diseases, may not be adequate for proper performance of an electrodiagnostic evaluation and correct interpretation of electrodiagnostic test results. Without awareness of the patterns of abnormality expected in different diseases and knowledge that the results of nerve conduction studies (NCS) and electromyography (EMG) may be similar in different diseases, diagnosis solely by EMG-NCS findings may be both inadequate and ultimately be detrimental to the patient.

5. Guidelines about proper qualifications for qualified health care professionals performing electrodiagnostic evaluations have been developed and published by AANEM (American Association of Neuromuscular and Electrodiagnostic Medicine) and other medical organizations, including the AMA, the American Academy of Neurology, the American Academy of Physical Medicine and Rehabilitation, American Neurological Association, the American Board of Physical Therapy Specialties (ABPTS) in Clinical Electrophysiology, and the Department of Veterans Affairs.

Repeat Testing

1. Repeat testing will be considered for reimbursement in the following clinical situations:
   a. When seen for new symptoms or additional diagnosis we would consider another evaluation for the determination of a second diagnosis. When a diagnosis such as amyotrophic lateral sclerosis (ALS) is suspected, but testing is inconclusive, additional testing may be warranted.
   b. When the disease process is one of rapid change, such as Guillain-Barré syndrome, it may be necessary for monitoring patient progress.
   c. Recovery from injury may warrant retesting to help determine need for surgery and when surgery should be performed.
2. The claim must be submitted with medical record documentation to support medical necessity of repeat testing. Professional providers should report modifier 22.

RATIONALE

This evidence review been updated with searches of the MEDLINE database. The most recent literature update was performed through April 25, 2021.
Evidence reviews assess whether a medical test is clinically useful. A useful test provides information to make a clinical management decision that improves the net health outcome. That is, the balance of benefits and harms is better when the test is used to manage the condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the test. The test must be technically reliable, clinically valid, and clinically useful for that purpose. Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful. Technical reliability is outside the scope of these reviews, and credible information on technical reliability is available from other sources.

SUSPECTED PERIPHERAL NEUROPATHY OR MYOPATHY

Clinical Context and Test Purpose

The purpose of electrodiagnostic testing in patients who have suspected peripheral neuropathy or myopathy is to aid in the diagnosis of disease and to guide treatment.

The question addressed in this evidence review is: Does electrodiagnostic testing improve health outcomes in patients who have suspected peripheral neuropathy or myopathy but no definitive diagnosis based on history, physical exam, and imaging studies?

The following PICO was used to select literature to inform this review.

Populations

The relevant population of interest is individuals who have suspected peripheral neuropathy or myopathy. The population falls into the broad categories of compressive neuropathies, nerve root compression, traumatic nerve injuries, generalized and focal neuropathies and myopathies, plexopathy, motor neuron disease, and neuromuscular junction disorders.

Interventions

The relevant intervention of interest is electrodiagnostic assessment, consisting of electromyography (EMG), nerve conduction studies (NCS), and related measures, to evaluate the integrity and electrical function of muscles and peripheral nerves.

The tests should be performed in a dedicated electrodiagnostic laboratory using equipment that provides an assessment of all parameters of the recorded signals. An EMS and NCS should be performed by a physician or by a trained technician under the direct supervision of a physician.

Comparators

The relevant comparators of interest are standard clinical diagnostic tools and practices currently being used to inform decisions on the diagnosis of suspected peripheral neuropathy or myopathy: history, physical exam, laboratory studies, and imaging studies when appropriate.

Outcomes

The clinical utility would be supported by a reduction in pain or other symptoms and improvement in functional measures and quality of life measures specific to the condition.

Alternatively, evidence of clinical utility may be derived from a chain of evidence linking improvement in diagnostic accuracy with improvements in treatment guided by a correct diagnosis.
Beneficial outcomes include aiding in the diagnosis of disease and guiding treatment that results in a reduction in symptoms such as pain, numbness, or tingling, and improvements in functional outcomes of muscle strength and quality of life measures.

If patients are diagnosed with peripheral neuropathies or myopathies based on inaccurate EMG or NCS results, unnecessary treatment may be initiated when watchful waiting may be the more appropriate management approach.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for randomized controlled trials;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.

Studies with duplicative or overlapping populations were excluded.

Clinically Valid

A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

In general, EMG and NCS are considered the criterion standards for establishing abnormalities of the electrical system of nerves and muscles, and hence there is a lack of a true reference standard.

Below are examples of representative literature on clinical validity.

CARPAL TUNNEL SYNDROME

Systematic Reviews

A 2016 clinical practice guideline on the management of carpal tunnel syndrome (CTS) was published by the American Academy of Orthopaedic Surgeons (AAOS), which included a systematic review of the literature as part of its guideline development process.[4,]The guideline found moderate evidence (evidence from 2 or more moderate quality studies) to support that "diagnostic questionnaires and/or electrodiagnosis studies could be used to aid the diagnosis of carpal tunnel syndrome." Furthermore, AAOS noted that the evaluation of electrodiagnostic tests requires a reference standard against which the performance of the diagnostic test can be compared, but there is currently no consensus supporting a single diagnostic tool as a reference standard for CTS.

Observational Studies

Two studies identified calculated the sensitivity and specificity of EMG and NCS.[5,6,] One study used Carpal Tunnel Syndrome-6 (CTS-6) test results as a comparator[5,] and the other used mean values of normal controls as comparators.[6,]

Fowler et al (2014) evaluated the diagnostic accuracy of electrodiagnostic testing and ultrasound for diagnosing CTS, using validated clinical diagnostic criteria as the reference standard (Table 2).[5,] The reference standard was a validated clinical diagnostic tool (CTS-6 score). The electrodiagnostic exam was considered positive when there was a distal motor latency of 4.2 ms or more or a distal sensory latency of 3.2 ms or more. Sensitivity, specificity, positive predictive value, and negative predictive values were calculated (Table 3). This study was limited by the imperfect nature of the reference standard (CTS-6 is not a true criterion standard for diagnosis) and suboptimal sensitivity.

Chang et al (2006) examined the sensitivity and specificity of various motor and sensory NCS parameters in 280 consecutive patients (360 hands) with suspected CTS and 150 normal controls (see Table 2).[6,] In the 360 hands with suspected CTS, 328 (91%) had at least 1 electrodiagnostic abnormality and 9% had normal exams. For individual NCS measures, the sensitivity ranged from 73% to 87% and the specificity ranged from 97% to 99% (see Table 3). Among the 150 controls, NCS readings were mostly within the normal range, with a few sensory and motor findings falling in the abnormal range.

Table 2. Summary of Nonrandomized Study Characteristics for Carpal Tunnel Syndrome

Study	Study Type	Country	Dates	Participants	Blinding	Testing
Fowler et al (2014)[5,]	Cross-sectional	U.S.	NR	• Consecutive patients referred to an upper-extremity practice for EMG testing • CTS-6 positive: 55 • CTS-6 negative: 30	EMG technician blinded to CTS-6 results	All patients underwent:(1) CTS-6, (2) ultrasound, and (3) electrodiagnostic testing
Chang et al (2006)[6,]	Cross-sectional	Taiwan	NR	• Consecutive patients presenting with ≥1 of the following: numbness, paresthesia, nocturnal awakening, weakness, or pain • CTS patients: 280 • Volunteer controls: 150	EMG technicians blinded to clinical information and diagnosis	All patients underwent the following EMG/NCS testing: motor DL, W-P MCV, sensory DL (D1), sensory DL (D2), sensory DL (D4), W-P SCV (D2), W-P SCT (D2), M-R and M-U

CTS: carpal tunnel syndrome; CTS-6: Carpal Tunnel Syndrome-6; D1: thumb; D2: index finger; D4: ring finger; DL: distal latency; EMG: electromyography; M-R: median-radial sensory latency difference; M-U: median-ulnar sensory latency difference; NCS: nerve conduction studies; NR: not reported; W-P MCV: wrist-palm motor conduction velocity; W-P SCT: wrist-palm sensory conduction time; W-P SCV: wrist-palm sensory conduction velocity.

Table 3. Summary of Nonrandomized Study Results for Carpal Tunnel Syndrome

Study	Sensitivity (95% CI), %		Specificity (95% CI), %		PPV (95% CI), %		NPV (95% CI), %	
	US[a]	EMG[a]	US[a]	EMG[a]	US[a]	EMG[a]	US[a]	EMG[a]
Fowler et al (2014)[5,]	89 (77 to 95)	89 (77 to 95)	90 (72 to 97)	80 (61 to 92)	94 (83 to 98)	89 (71 to 95)	82 (64 to 92)	80 (61 to 92)

Chang et al (2006)[6,]				
Motor DL[b]	65.0	99.3	NR	NR
SDL (D1)[b]	80.3	98.7	NR	NR
SDL (D2)[b]	72.5	99.3	NR	NR
SDL (D4)[b]	76.7	100	NR	NR
W-P MCV[b]	81.7	100	NR	NR
W-P SCV[b]	73.6	100	NR	NR
W-P SCT[b]	80.8	100	NR	NR
M-R[b]	86.7	98.7	NR	NR
M-U[b]	87.2	96.7	NR	NR

CI: confidence interval; D1: thumb; D2: index finger; D4: ring finger; DL: distal latency; EMG: electromyography; M-R: median-radial sensory latency difference; M-U: median-ulnar sensory latency difference; NPV: negative predictive value; NR: not reported; PPV: positive predictive value; SDL: sensory distal latency; US: ultrasound; W-P MCV: wrist-palm motor conduction velocity; W-P SCT: wrist-palm sensory conduction time; W-P SCV: wrist-palm sensory conduction velocity.
[a] Compared with Carpal Tunnel Syndrome-6 test results
[b] Compared with mean values of normal controls ± 2.5 standard deviations.

Two studies calculated correlations between EMG and NCS with other measures rather than calculating sensitivity and sensitivity.[7,8,] Homan et al (1999) evaluated the association among clinical symptoms, physical exam, and electrodiagnostic studies in 824 individuals with suspected work-related CTS from 6 job facilities.[7,] A total of 449 individuals had at least 1 positive finding on any exam. Of these, only 3% had positive findings on all 3 domains (symptoms, physical exam, NCS). Overall, there was poor agreement across the 3 measures (κ range, 0-0.18). Tulipan et al (2017) retrospectively studied 50 patients presenting for CTS treatment.[8,] Patients completed the Disabilities of the Arm, Shoulder, and Hand questionnaire and the 12-Item Short-Form Health Survey. There were no significant correlations between Disabilities of the Arm, Shoulder, and Hand questionnaire and the 12-Item Short-Form Health Survey scores with median motor or sensory latency measures.

Lumbar Radiculopathy

The North American Spine Society published evidence-based guidelines on the diagnosis and treatment of lumbar radiculopathy in 2012.[9,] These guidelines were based on a systematic review of the literature identifying studies of diagnostic techniques. Five studies on the diagnostic accuracy of electrophysiologic tests were discussed; 2 case-control studies and 3 case series. Sensitivities for various EMG and NCS parameters ranged from 17% to 65%. In the 2 studies that included a normal control group, specificity for EMG abnormalities was 100% and 87%, respectively.

After the North American Spine Society publication, Mondelli et al (2013) evaluated EMG findings in patients with lumbosacral radiculopathy and herniated disc. The diagnosis of radiculopathy due to herniated disc was based on a combination of clinical symptoms and magnetic resonance imaging results.[10,] A total of 108 consecutive patients with monoradiculopathy at L4, L5, or S1 were enrolled from 4 electrodiagnostic laboratories. At least 1 EMG abnormality was recorded in 42% of patients, with the most common being a delay in the F wave minimum latency. EMG

abnormalities could be predicted on multivariate regression by the presence of clinical symptoms, including muscle weakness, abnormal reflexes, and the presence of paresthesias.

Peroneal Neuropathy

The Association of Neuromuscular & Electrodiagnostic Medicine (AANEM; 2005) published an evidence review in support of practice parameters on the utility of electrodiagnostic testing for patients with suspected peroneal neuropathy.[11,] Reviewers performed a systematic review of the literature through July 2003 on the utility of EMG/NCS. Eleven studies met inclusion criteria, 4 of which were prospective. Eight studies described the use of motor NCS, 8 described the use of sensory NCS, and 5 described the use of needle EMG. Strength of evidence assessments considered the studies to be class III or IV level of evidence. The strongest study design (n=4 studies) used a cohort of patients with clinically diagnosed peroneal neuropathy and reported the sensitivity of EMG/NCS. Sensitivity rates for EMG/NCS varied widely by the type of measure, and the specific area tested, ranging from 19% to 91%. Specificity was not reported. Reviewers concluded that certain NCS parameters were useful for diagnosing peroneal neuropathy and proposed a specific testing strategy to maximize sensitivity. EMG was not found to be useful for confirming the diagnosis of peroneal neuropathy but was helpful in excluding alternative diagnoses.

Pediatric Myopathy

Evidence was identified comparing the accuracy of EMG and NCS with muscle biopsy in children with a suspected myopathy. The intent of this line of research is to evaluate whether a diagnosis can be made with certainty using clinical exam plus EMG or NCS, thereby avoiding muscle biopsy.

Rabie et al (2007) compared the diagnostic accuracy of EMG with muscle biopsy in children who had neuropathies or myopathies.[12,] The authors retrospectively identified 27 children between the ages of 6 days to 16 years who had EMG studies, a muscle biopsy, and a final diagnosis assigned by the treating physician(s). Final diagnoses were congenital myopathy (5 patients), nonspecific myopathy (6 patients), congenital myasthenic syndrome (3 patients), juvenile myasthenia gravis (1 patient), arthrogryposis multiplex congenital (2 patients), hereditary motor and sensory neuropathy (1 patient), bilateral peroneal neuropathies (1 patient), and normal (8 patients). In general, the sensitivity of EMG for detecting abnormalities implied by the final diagnosis was low. For example, the sensitivity of EMG for detecting myopathic motor unit potentials in any myopathy was 47% (7/15), and the sensitivity for congenital myopathies was 40% (2/5). The sensitivity was especially low for patients younger than 2 years of age compared with older children, but this comparison was limited by small numbers of patients in each group.

Ghosh and Sorenson (2014) performed a retrospective chart review of 227 patients who received EMG studies between 2009 and 2013.[13,] Seventy-two (32%) patients also received muscle biopsy, and these 72 patients constituted the study group. The criterion standard was myopathy confirmed by muscle biopsy or by genetic testing. The overall sensitivity of EMG was 91%, with the most commonly missed diagnosis being metabolic myopathy. The overall specificity was 67%, which is lower than most other reports of specificity, raises concern whether the sensitivity of muscle biopsy is lower than expected, thus resulting in EMG results that are true-positives being classified as false-positives.

Section Summary: Clinically Valid

EMG/NCS testing is generally considered to be specific but not sensitive. However, the evidence on the diagnostic accuracy of EMG and NCS is poor, in part because of the lack of a true

reference standard. In the scattered evidence identified, sensitivity was often less than 50%, and specificity was most commonly in the range of 80% to 100%. Because of the small quantity and poor quality of the evidence, precise estimates of sensitivity and specificity for specific disorders cannot be made.

Clinically Useful
A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, or more effective therapy, or avoid unnecessary therapy, or avoid unnecessary testing.

To determine the clinical utility of EMG and NCS, studies need to evaluate the use of EMG and NCS testing to guide treatment decisions and then report health outcomes following the treatments. No studies of this type were identified.

Chain of Evidence
Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

The lack of high-quality evidence on the clinical utility of EMG and NCS is reflected by the lack of evidence-based guidelines. Most existing guidelines rely on expert consensus. This section reviews guidelines from 3 organizations, focusing on the methods of the development process, and the rigor of evidence review. The 3 organizations are AANEM, AAOS (CTS only), and the American Academy of Neurology (AAN). The Practice Guidelines and Position Statements discussion in the Supplemental Information section summarizes the recommendations of the guidelines.

The AANEM (2009) made recommendations on electrodiagnostic medicine based on the consensus of 43 experts in the field of electrodiagnostic medicine.[2,] The AANEM provided no information on the selection process for these individuals but noted that they were neurologists or physiatrists representing diverse practice types and locations.

The AAOS (2016) published practice guidelines on the diagnosis and treatment of CTS.[4,] The authors included both practicing physicians, as clinical experts, and methodologists who were free of potential conflicts of interest. The guideline was developed by creating structured PICO questions, which directed the systematic literature search. Upon completion of the systematic reviews, the physician experts and methodologists evaluated and integrated all material to develop the final recommendations, which were based only on the best available evidence for any given outcome.

The AAN (2004) published a position statement on electrodiagnostic assessment.[14,] According to AAN, "A position statement is a concise explanation of AAN's position on a certain issue that includes background information and the rationale behind the Academy's position. The position statement, generally not exceeding 1000 words, is in-depth and must reference all supporting evidence." The AAN document on EMG did not provide a literature review or references to accompany recommendations.

Section Summary: Clinically Useful
No studies were identified that evaluated clinical utility. Existing guidelines from prominent major specialty societies in electrodiagnostic medicine consist primarily of expert consensus. For

guidelines based on an evidence review, such as the AAOS guidelines, the evidence was not sufficient to make evidence-based recommendations. All 3 societies have included general recommendations on the utility of electrodiagnostic testing as an adjunct to clinical diagnosis for myopathic and neuropathic disorders. Guidelines supporting these recommendations do not offer detailed indications for patient testing by diagnosis.

Summary of Evidence

For individuals with suspected peripheral neuropathy or myopathy who receive electrodiagnostic assessment including EMG and NCS, the evidence includes small observational studies on a few diagnoses, such as carpal tunnel syndrome, radiculopathy, and myopathy. Relevant outcomes are test accuracy, symptoms, functional outcomes, and quality of life. Because electrodiagnostic assessment is considered the criterion standard for evaluating the electrical function of peripheral nerves and muscles, there is no true alternative reference standard against which the sensitivity and specificity of particular EMG/NCS abnormalities for particular clinical disorders can be calculated. Different studies have used different reference standards, such as EMG/NCS measures of healthy individuals or clinical examination results. In general, these tests are considered more specific than sensitive, and normal results do not rule out the disease. The limited evidence has shown a wide range of sensitivities, which are often less than 50%. The specificity is expected to be considerably higher but the data are insufficient to provide precise estimates of either sensitivity or specificity. The evidence is insufficient to determine that the technology results in an improvement in the health net outcome.

SUPPLEMENTAL INFORMATION

The purpose of the following information is to provide reference material. Inclusion does not imply endorsement or alignment with the evidence review conclusions.

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in ‘Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American Association of Neuromuscular & Electrodiagnostic Medicine

The American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) has published several position statements on the recommended coverage policy for electromyography (EMG) and nerve conduction study (NCS). The first, initially published in 1999, was updated in 2004. The second was published in 2017.[15,] Needle EMG and NCS testing was recommended for the following indications:

1. "Focal neuropathies, entrapment neuropathies, or compressive lesions/syndromes such as carpal tunnel syndrome, ulnar neuropathies, or root lesions, for localization
2. Traumatic nerve lesions, for diagnosis and prognosis
3. Diagnosis or confirmation of suspected generalized neuropathies, such as diabetic, uremic, metabolic, or immune
4. Repetitive nerve stimulation in diagnosis of neuromuscular junction disorders such as myasthenia gravis, myasthenic syndrome
5. Symptom-based presentations such as ‘pain in limb', weakness, disturbance in skin sensation or ‘paresthesia' when appropriate pretest evaluations are inconclusive and the clinical assessment unequivocally supports the need for the study

6. Radiculopathy-cervical, lumbosacral
7. Polyneuropathy-metabolic, degenerative, hereditary
8. Plexopathy-idiopathic, trauma, infiltration
9. Myopathy-including polymyositis and dermatomyositis, myotonic, and congenital myopathies
10. Precise muscle location for injections such as botulinum toxin, phenol, etc."

This document also listed situations where electrodiagnostic assessment is considered investigational.

In 2005, the AANEM published practice parameters on the utility of EMG/NCS for the diagnosis of peroneal neuropathy.[11,] This evidence-based review focused on whether EMG/NCS are useful in diagnosing peroneal neuropathy and/or in determining prognosis. Table 4 lists recommendations AANEM deemed "possibly useful, to make or confirm" a diagnosis.

Table 4. Guidelines on Diagnosis of Peroneal Neuropathy

Recommendation	LOR	COE
Motor NCSs of the peroneal nerve recording from the AT and EDB muscles	C	III
Orthodromic and antidromic superficial peroneal sensory NCS	C	III
At least 1 additional normal motor and sensory NCS in the same limb, to assure that the peroneal neuropathy is isolated, and not part of a more widespread local or systemic neuropathy		
Data are insufficient to determine the role of needle EMG in making the diagnosis of peroneal neuropathy. However, abnormalities on needle examination outside of the distribution of the peroneal nerve should suggest alternative diagnoses	U	IV Expert
In patients with confirmed peroneal neuropathy, EDX studies are possibly useful in providing prognostic information, with regards to recovery of function	C	III/IV

AT: anterior tibialis; COE: class of evidence; EDB: extensor digitorum brevis; EDX: electrodiagnostic; EMG: electromyography; LOR: level of recommendation; NCS: nerve conduction study.

A 2003 consensus statement on diagnosing multifocal motor neuropathy from AANEM[16,] has stated:

"Multifocal motor neuropathy is a diagnosis that is based on recognition of a characteristic pattern of clinical symptoms, clinical signs, and electrodiagnostic findings. The fundamental electrodiagnostic finding is partial conduction block of motor axons."

In 2004, the AANEM approved a position statement, endorsed by the American Academy of Neurology and the American Academy of Physical Medicine & Rehabilitation, on diagnostic electromyography included the following[14,]:

- "Clinical needle electromyography (EMG) is an invasive medical procedure during which the physician inserts an electrode into a patient's muscles to diagnose the cause of muscle weakness. Needle EMG allows physicians to distinguish a wide range of conditions, from carpal tunnel syndrome to ALS (Lou Gehrig disease).
- Needle EMG is also an integral component of the neurological examination that cannot be separated from the physician's evaluation of the patient. The test is dynamic and depends upon the visual, tactile, and audio observations of the examiner. There is no way for physicians to independently verify the accuracy of reports performed by non-physicians.

- Misdiagnosis can mean delayed or inappropriate treatment (including surgery) and diminished quality of life. Because needle EMG is strictly diagnostic, the procedure clearly and exclusively falls within the practice of medicine."

In 2018, the AANEM published a policy statement on the use of EMG for distal symmetric polyneuropathy.[15,] The statement described 5 situations in which EMG would be beneficial for patients with distal symmetric polyneuropathy: "1) determining primary and alternative diagnoses; 2) determining severity, duration, and prognosis of disease; 3) evaluating risk of associated problems; 4) determining the effect of medications; and 5) evaluating the effect of toxic exposures."

In 2020, the AANEM issued a consensus statement on the utility and practice of electrodiagnostic (EDX) testing in the pediatric population.[17,] The following conclusions were made:

- "...certain categories of inherited diseases such as muscular dystrophy and SMA [spinal muscular atrophy] do not routinely require EMG as part of the diagnostic evaluation. However, in atypical cases EDX testing can provide critical assistance with narrowing of the differential diagnosis."
- "...techniques and practice for this important diagnostic test modality will continue to evolve in the future."
- "EDX testing in children will continue to complement other diagnostic test modalities such as serum tests, muscle biopsy, imaging, and genetic testing."

American Academy of Orthopaedic Surgeons

In 2007, the American Academy of Orthopaedic Surgeons (AAOS) issued guidelines on the diagnosis of carpal tunnel syndrome. Table 5 lists recommendations made.

Table 5. Guidelines on Diagnosis of Carpal Tunnel Syndrome

No.	Recommendation	LOR	GOE
3.1a	"The physician may obtain electrodiagnostic tests to differentiate among diagnoses."	V	C
3.1b	"The physician may obtain electrodiagnostic tests in the presence of thenar atrophy and/or persistent numbness."	V	C
3.1c	"The physician should obtain electrodiagnostic tests if clinical and/or provocative tests are positive and surgical management is being considered."	II/III	B
3.2	"If the physician orders electrodiagnostic tests, the testing protocol should follow the AAN/AANEM/AAPMR guidelines for diagnosis of CTS."	IV/V	C

AANEM: American Association of Neuromuscular & Electrodiagnostic Medicine; AAN: American Academy of Neurology; AAPM&R: American Academy of Physical Medicine and Rehabilitation; CTS: carpal tunnel syndrome; GOE: grade of evidence; LOR: level of recommendation (II/III: "fair evidence"; IV/V: "poor quality evidence"; V: "expert consensus").

In 2016, the AAOS issued guidelines on the management of carpal tunnel syndrome.[4,] Table 6 lists recommendations made.

Table 6. Guidelines on Management of Carpal Tunnel Syndrome

Recommendation	Strength of Recommendation
"Limited evidence supports that a hand-held nerve conduction study (NCS) device might be used for the diagnostic of carpal tunnel syndrome."	Limited

Recommendation	Strength of Recommendation
"Moderate evidence supports that diagnostic questionnaires and/or electrodiagnostic studies could be used to aid the diagnosis of carpal tunnel syndrome."	Moderate

North American Spine Society
In 2012, the North American Spine Society published guidelines on the diagnosis and treatment of lumbar disc herniation.[9,] This document made the following statement about the use of EMG/NCS for diagnosis of lumbar disc herniation:

"Electromyography, nerve conduction studies and F-waves are suggested to have limited utility in the diagnosis of lumbar disc herniation with radiculopathy. H-reflexes can be helpful in the diagnosis of an S1 radiculopathy, though are not specific to the diagnosis of lumbar disc herniation. (Grade of Recommendation: B)"

U.S. Preventive Services Task Force Recommendations
Not applicable.

Ongoing and Unpublished Clinical Trials
A search of ClinicalTrials.gov in April 2021 did not identify any ongoing or unpublished trials that would likely influence this review.

Evidence reviews assess whether a medical test is clinically useful. A useful test provides information to make a clinical management decision that improves the net health outcome. That is, the balance of benefits and harms is better when the test is used to manage the condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the test. The test must be technically reliable, clinically valid, and clinically useful for that purpose. Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful. Technical reliability is outside the scope of these reviews, and credible information on technical reliability is available from other sources.

Suspected Peripheral Neuropathy or Myopathy

Clinical Context and Test Purpose
The purpose of electrodiagnostic testing in patients who have suspected peripheral neuropathy or myopathy is to aid in the diagnosis of disease and to guide treatment.

The question addressed in this evidence review is: Does electrodiagnostic testing improve health outcomes in patients who have suspected peripheral neuropathy or myopathy but no definitive diagnosis based on history, physical exam, and imaging studies?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest are individuals who have suspected peripheral neuropathy or myopathy. The population falls into the broad categories of compressive neuropathies, nerve root

compression, traumatic nerve injuries, generalized and focal neuropathies and myopathies, plexopathy, motor neuron disease, and neuromuscular junction disorders.

Interventions

The relevant intervention of interest is electrodiagnostic assessment, consisting of electromyography (EMG), nerve conduction studies (NCS), and related measures, to evaluate the integrity and electrical function of muscles and peripheral nerves.

Comparators

The relevant comparators of interest are standard clinical diagnostic tools and practices currently being used to inform decisions on the diagnosis of suspected peripheral neuropathy or myopathy: history, physical exam, and imaging studies when appropriate.

Outcomes

The clinical utility would be supported by a reduction in pain or other symptoms and improvement in functional measures and quality of life measures specific to the condition. Alternatively, evidence of clinical utility may be derived from a chain of evidence linking improvement in diagnostic accuracy with improvements in treatment guided by a correct diagnosis.

Beneficial outcomes include aiding in the diagnosis of disease and guiding treatment that results in a reduction in symptoms such as pain, numbness, or tingling, and improvements in functional outcomes of muscle strength and quality of life measures.

If patients are diagnosed with peripheral neuropathies or myopathies based on inaccurate EMG or NCS results, unnecessary treatment may be initiated when watchful waiting may be the more appropriate management approach.

The tests should be performed in a dedicated electrodiagnostic laboratory using equipment that provides an assessment of all parameters of the recorded signals. An EMS and NCS should be performed by a physician or by a trained technician under the direct supervision of a physician.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

a. To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for randomized controlled trials;
b. In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
c. To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.

Studies with duplicative or overlapping populations were excluded.

Technically Reliable

Assessment of technical reliability focuses on specific tests and operators and requires a review of unpublished and often proprietary information. Review of specific tests, operators, and unpublished data are outside the scope of this evidence review, and alternative sources exist. This evidence review focuses on the clinical validity and clinical utility.

Clinically Valid
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

In general, EMG and NCS are considered the criterion standards for establishing abnormalities of the electrical system of nerves and muscles, and hence there is a lack of a true reference standard.

Below are examples of representative literature on clinical validity.

Carpal Tunnel Syndrome

Systematic Reviews
A 2004 systematic review of the literature on the diagnosis of carpal tunnel syndrome (CTS) was performed by the American Academy of Orthopaedic Surgeons (AAOS) in support of its guideline development process.[4,] No prospective studies were identified that enrolled a population of patients similar to that seen in clinical practice. AAOS offered the following appraisal of the evidence base:
"The systematic literature review of primary studies indicated that published articles did not employ a consistent reference standard, few studies evaluated the same diagnostic test, and most studies enrolled only a few patients. In addition, the majority of primary studies used a case-control design, which is subject to spectrum bias, thus artificially inflating the sensitivity and specificity of the evaluated tests. Because of the diversity and suboptimal design of published studies, no one test could be identified as a 'gold standard' for carpal tunnel syndrome diagnosis."

As a result, AAOS concluded that the sensitivity and specificity of electrodiagnostic assessment for CTS were unknown. Evidence-based recommendations could not be developed, and all recommendations were therefore rated at a level V (expert opinion).

Observational Studies
Two studies identified calculated the sensitivity and specificity of EMG and NCS.[5,6,] One study used Carpal Tunnel Syndrome-6 (CTS-6) test results as a comparator[5,] and the other used mean values of normal controls as comparators.[6,]

Fowler et al (2014) evaluated the diagnostic accuracy of electrodiagnostic testing and ultrasound for diagnosing CTS, using validated clinical diagnostic criteria as the reference standard (see Table 2).[5,] The reference standard was a validated clinical diagnostic tool (CTS-6 score). The electrodiagnostic exam was considered positive when there was a distal motor latency of 4.2 ms or more or a distal sensory latency of 3.2 ms or more. Sensitivity, specificity, positive predictive value, and negative predictive values were calculated (see Table 3). This study was limited by the imperfect nature of the reference standard (CTS-6 is not a true criterion standard for diagnosis) and suboptimal sensitivity.

Chang et al (2006) examined the sensitivity and specificity of various motor and sensory NCS parameters in 280 consecutive patients (360 hands) with suspected CTS and 150 normal controls (see Table 2).[6,] In the 360 hands with suspected CTS, 328 (91%) had at least 1 electrodiagnostic abnormality and 9% had normal exams. For individual NCS measures, the sensitivity ranged from 73% to 87% and the specificity ranged from 97% to 99% (see Table 3). Among the 150

controls, NCS readings were mostly within the normal range, with a few sensory and motor findings falling in the abnormal range.

Table 2. Summary of Nonrandomized Study Characteristics for Carpal Tunnel Syndrome

Study	Study Type	Country	Dates	Participants	Blinding	Testing
Fowler et al (2014)[5,]	Cross-sectional	U.S.	NR	• Consecutive patients referred to an upper-extremity practice for EMG testing • CTS-6 positive: 55 • CTS-6 negative: 30	EMG technician blinded to CTS-6 results	All patients underwent: (1) CTS-6, (2) ultrasound, and (3) electrodiagnostic testing
Chang et al (2006)[6,]	Cross-sectional	Taiwan	NR	• Consecutive patients presenting with ≥1 of the following: numbness, paresthesia, nocturnal awakening, weakness, or pain • CTS patients: 280 • Volunteer controls: 150	EMG technicians blinded to clinical information and diagnosis	All patients underwent the following EMG/NCS testing: motor DL, W-P MCV, sensory DL (D1), sensory DL (D2), sensory DL (D4), W-P SCV (D2), W-P SCT (D2), M-R and M-U

CTS-6: Carpal Tunnel Syndrome-6; D1: thumb; D2: index finger; D4: ring finger; DL: distal latency; EMG: electromyography; M-R: median-radial sensory latency difference; M-U: median-ulnar sensory latency difference; NCS: nerve conduction studies; NR: not reported; W-P MCV: wrist-palm motor conduction velocity; W-P SCT: wrist-palm sensory conduction time; W-P SCV: wrist-palm sensory conduction velocity.

Table 3**. Summary of Nonrandomized Study Results for Carpal Tunnel Syndrome**

Study	Sensitivity (95% CI), %		Specificity (95% CI), %		PPV (95% CI), %		NPV (95% CI), %	
	US[a]	EMG[a]	US[a]	EMG[a]	US[a]	EMG[a]	US[a]	EMG[a]
Fowler et al (2014)[5,]	89 (77 to 95)	89 (77 to 95)	90 (72 to 97)	80 (61 to 92)	94 (83 to 98)	89 (71 to 95)	82 (64 to 92)	80 (61 to 92)
Chang et al (2006)[6,]								
Motor DL[b]	65.0		99.3		NR		NR	
SDL (D1)[b]	80.3		98.7		NR		NR	
SDL (D2)[b]	72.5		99.3		NR		NR	
SDL (D4)[b]	76.7		100		NR		NR	
W-P MCV[b]	81.7		100		NR		NR	
W-P SCV[b]	73.6		100		NR		NR	
W-P SCT[b]	80.8		100		NR		NR	
M-R[b]	86.7		98.7		NR		NR	
M-U[b]	87.2		96.7		NR		NR	

CI: confidence interval; D1: thumb; D2: index finger; D4: ring finger; DL: distal latency; EMG: electromyography; M-R: median-radial sensory latency difference; M-U: median-ulnar sensory latency difference; NPV: negative predictive value; NR: not reported; PPV: positive predictive value; SDL: sensory distal latency; US: ultrasound; W-P MCV: wrist-palm motor conduction velocity; W-P SCT: wrist-palm sensory conduction time; W-P SCV: wrist-palm sensory conduction velocity.

[a] Compared with Carpal Tunnel Syndrome-6 test results

[b] Compared with mean values of normal controls ± 2.5 standard deviations.

Two studies calculated correlations between EMG and NCS with other measures rather than calculating sensitivity and sensitivity.[7,8,] Homan et al (1999) evaluated the association among clinical symptoms, physical exam, and electrodiagnostic studies in 824 individuals with suspected work-related CTS from 6 job facilities.[7,] A total of 449 individuals had at least 1 positive finding on any exam. Of these, only 3% had positive findings on all three domains (symptoms, physical

exam, NCS). Overall, there was poor agreement across the 3 measures (κ range, 0-0.18). Tulipan et al (2017) retrospectively studied 50 patients presenting for CTS treatment.[8,] Patients completed the Disabilities of the Arm, Shoulder, and Hand questionnaire and the 12-Item Short-Form Health Survey. There were no significant correlations between Disabilities of the Arm, Shoulder, and Hand questionnaire and the 12-Item Short-Form Health Survey scores with median motor or sensory latency measures.

Lumbar Radiculopathy

The North American Spine Society published evidence-based guidelines on the diagnosis and treatment of lumbar radiculopathy in 2012.[9,] These guidelines were based on a systematic review of the literature identifying studies of diagnostic techniques. Five studies on the diagnostic accuracy of electrophysiologic tests were discussed-two case-control studies and three case series. Sensitivities for various EMG and NCS parameters ranged from 17% to 65%. In the 2 studies that included a normal control group, specificity for EMG abnormalities was 100% and 87%, respectively.

After the North American Spine Society publication, Mondelli et al (2013) evaluated EMG findings in patients with lumbosacral radiculopathy and herniated disc. The diagnosis of radiculopathy due to herniated disc was based on a combination of clinical symptoms and magnetic resonance imaging results.[10,] A total of 108 consecutive patients with monoradiculopathy at L4, L5, or S1 were enrolled from 4 electrodiagnostic laboratories. At least 1 EMG abnormality was recorded in 42% of patients, with the most common being a delay in the F wave minimum latency. EMG abnormalities could be predicted on multivariate regression by the presence of clinical symptoms, including muscle weakness, abnormal reflexes, and the presence of paresthesias.

Peroneal Neuropathy

The Association of Neuromuscular & Electrodiagnostic Medicine (AANEM;2005) published an evidence review in support of practice parameters on the utility of electrodiagnostic testing for patients with suspected peroneal neuropathy.[11,] Reviewers performed a systematic review of the literature through July 2003 on the utility of EMG/NCS. Eleven studies met inclusion criteria, four of which were prospective. Eight studies described the use of motor NCS, eight described the use of sensory NCS, and five described the use of needle EMG. Strength of evidence assessments considered the studies to be class III or IV level of evidence. The strongest study design (n=4 studies) used a cohort of patients with clinically diagnosed peroneal neuropathy and reported the sensitivity of EMG/NCS. Sensitivity rates for EMG/NCS varied widely by the type of measure, and the specific area tested, ranging from 19% to 91%. Specificity was not reported. Reviewers concluded that certain NCS parameters were useful for diagnosing peroneal neuropathy and proposed a specific testing strategy to maximize sensitivity. EMG was not found to be useful for confirming the diagnosis of peroneal neuropathy but was helpful in excluding alternative diagnoses.

Pediatric Myopathy

Evidence was identified comparing the accuracy of EMG and NCS with muscle biopsy in children with a suspected myopathy. The intent of this line of research is to evaluate whether a diagnosis can be made with certainty using clinical exam plus EMG or NCS, thereby avoiding muscle biopsy.

Rabie et al (2007) compared the diagnostic accuracy of EMG with muscle biopsy in children who had neuropathies or myopathies.[12,] The authors retrospectively identified 27 children between the ages of 6 days to 16 years who had EMG studies, a muscle biopsy, and a final diagnosis assigned

by the treating physician(s). Final diagnoses were congenital myopathy (five patients), nonspecific myopathy (six patients), congenital myasthenic syndrome (three patients), juvenile myasthenia gravis (one patient), arthrogryposis multiplex congenital (two patients), hereditary motor and sensory neuropathy (one patient), bilateral peroneal neuropathies (one patient), and normal (eight patients). In general, the sensitivity of EMG for detecting abnormalities implied by the final diagnosis was low. For example, the sensitivity of EMG for detecting myopathic motor unit potentials in any myopathy was 47% (7/15), and the sensitivity for congenital myopathies was 40% (2/5). The sensitivity was especially low for patients younger than two years of age compared with older children, but this comparison was limited by small numbers of patients in each group.

Ghosh and Sorenson (2014) performed a retrospective chart review of 227 patients who received EMG studies between the 2009 and 2013.[13] Seventy-two (32%) patients also received muscle biopsy, and these 72 patients constituted the study group. The criterion standard was myopathy confirmed by muscle biopsy or by genetic testing. The overall sensitivity of EMG was 91%, with the most commonly missed diagnosis being metabolic myopathy. The overall specificity was 67%, which is lower than most other reports of specificity, raises concern whether the sensitivity of muscle biopsy is lower than expected, thus resulting in EMG results that are true-positives being classified as false-positives.

Section Summary: Clinically Valid
EMG/NCS testing is generally considered to be specific but not sensitive. However, the evidence on the diagnostic accuracy of EMG and NCS is poor, in part because of the lack of a true reference standard. In the scattered evidence identified, sensitivity was often less than 50%, and specificity was most commonly in the range of 80% to 100%. Because of the small quantity and poor quality of the evidence, precise estimates of sensitivity and specificity for specific disorders cannot be made.

Clinically Useful
A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, or more effective therapy, or avoid unnecessary therapy, or avoid unnecessary testing.

To determine the clinical utility of EMG and NCS, studies need to evaluate the use of EMG and NCS testing to guide treatment decisions and then report health outcomes following the treatments. No studies of this type were identified.

Chain of Evidence
Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

The lack of high-quality evidence on the clinical utility of EMG and NCS is reflected by the lack of evidence-based guidelines. Most existing guidelines rely on expert consensus. This section reviews guidelines from three organizations, focusing on the methods of the development process, and the rigor of evidence review. The three organizations are AANEM, AAOS (CTS only), and the American Academy of Neurology (AAN). The Practice Guidelines and Position Statements discussion in the Supplemental Information section summarizes the recommendations of the guidelines.

The AANEM (2009) made recommendations on electrodiagnostic medicine based on the consensus of 43 experts in the field of electrodiagnostic medicine.[2,]The AANEM provided no information on the selection process for these individuals but noted that they were neurologists or physiatrists representing diverse practice types and locations.

The AAOS (2007) published practice guidelines on the diagnosis and treatment of CTS.[13,]The AAOS made the following statement on its guideline methodology:

"The AAOS Carpal Tunnel Syndrome (CTS) Guideline Work Group systematically reviewed the available literature, evaluated the level of evidence found in that literature, and subsequently wrote the following recommendations based on a rigorous, standardized consensus process.

Multiple iterations of written review were conducted by the participating Work Group, AAOS Guidelines Oversight Committee, AAOS Evidence-based Practice Committee, and the AAOS Council on Research, Quality Assessment, and Technology prior to final approval by the AAOS Board of Directors."

Consensus on guideline recommendations was reached using a modification of the nominal group technique.

The AAN (2004) published a position statement on electrodiagnostic assessment.[14,] According to AAN, "A position statement is a concise explanation of AAN's position on a certain issue that includes background information and the rationale behind the Academy's position. The position statement, generally not exceeding 1000 words, is in-depth and must reference all supporting evidence." The AAN document on EMG did not provide a literature review or references to accompany recommendations.

Section Summary: Clinically Useful

No studies were identified that evaluated clinical utility. Existing guidelines from prominent major specialty societies in electrodiagnostic medicine consist primarily of expert consensus. For guidelines based on an evidence review, such as the AAOS guidelines, the evidence was not sufficient to make evidence-based recommendations. All three societies have included general recommendations on the utility of electrodiagnostic testing as an adjunct to clinical diagnosis for myopathic and neuropathic disorders. Guidelines supporting these recommendations do not offer detailed indications for patient testing by diagnosis.

Summary of Evidence

For individuals with suspected peripheral neuropathy or myopathy who receive electrodiagnostic assessment including EMG and NCS, the evidence includes small observational studies on a few diagnoses, such as CTS, radiculopathy, and myopathy. The relevant outcomes are test accuracy, symptoms, functional outcomes, and quality of life. Because electrodiagnostic assessment is considered the criterion standard for evaluating the electrical function of peripheral nerves and muscles, there is no true alternative reference standard against which the sensitivity and specificity of particular EMG/NCS abnormalities for particular clinical disorders can be calculated. Different studies have used different reference standards, such as EMG/NCS measures of healthy individuals or clinical examination results. In general, these tests are considered more specific than sensitive, and normal results do not rule out the disease. The limited evidence has shown a wide range of sensitivities, which are often less than 50%. The specificity is expected to be considerably higher but the data are insufficient to provide precise estimates of either sensitivity

or specificity. The evidence is insufficient to determine the effects of the technology on health outcomes.

Practice Guidelines and Position Statements

American Association of Neuromuscular & Electrodiagnostic Medicine
The AANEM has published several position statements on the recommended coverage policy for electromyography (EMG) and nerve conduction study (NCS). The first, initially published in 1999, was updated in 2004. The second was published in 2010.[16] Needle EMG and NCS testing was recommended for the following indications:

1. "Focal neuropathies, entrapment neuropathies, or compressive lesions/syndromes such as carpal tunnel syndrome, ulnar neuropathies, or root lesions, for localization
2. Traumatic nerve lesions, for diagnosis and prognosis
3. Diagnosis or confirmation of suspected generalized neuropathies, such as diabetic, uremic, metabolic, or immune
4. Repetitive nerve stimulation in diagnosis of neuromuscular junction disorders such as myasthenia gravis, myasthenic syndrome
5. Symptom-based presentations such as ‘pain in limb', weakness, disturbance in skin sensation or ‘paresthesia' when appropriate pretest evaluations are inconclusive and the clinical assessment unequivocally supports the need for the study
6. Radiculopathy-cervical, lumbosacral
7. Polyneuropathy-metabolic, degenerative, hereditary
8. Plexopathy-idiopathic, trauma, infiltration
9. Myopathy-including polymyositis and dermatomyositis, myotonic, and congenital myopathies
10. Precise muscle location for injections such as botulinum toxin, phenol, etc."

This document also listed situations where electrodiagnostic assessment is considered investigational.

The AANEM (2005) published practice parameters on the utility of EMG/NCS for the diagnosis of peroneal neuropathy.[11,] This evidence-based review focused on whether EMG/NCS are useful in diagnosing peroneal neuropathy and/or in determining prognosis. Table 4 lists recommendations AANEM deemed "possibly useful, to make or confirm" a diagnosis.

Table 4. Guidelines on Diagnosis of Peroneal Neuropathy

Recommendation	LOR	COE
Motor NCSs of the peroneal nerve recording from the AT and EDB muscles	C	III
Orthodromic and antidromic superficial peroneal sensory NCS	C	III
At least one additional normal motor and sensory NCS in the same limb, to assure that the peroneal neuropathy is isolated, and not part of a more widespread local or systemic neuropathy		
Data are insufficient to determine the role of needle EMG in making the diagnosis of peroneal neuropathy However, abnormalities on needle examination outside of the distribution of the peroneal nerve should suggest alternative diagnoses	U	IV Expert
In patients with confirmed peroneal neuropathy, EDX studies are possibly useful in providing prognostic information, with regards to recovery of function	C	III/IV

AT: anterior tibialis; COE: class of evidence; EDB: extensor digitorumbrevis; EDX: electrodiagnostic; EMG: electromyography; LOR: level of recommendation; NCS: nerve conduction study.

A 2003 consensus statement on diagnosing multifocal motor neuropathy from AANEM[15,] has stated:

"Multifocal motor neuropathy is a diagnosis that is based on recognition of a characteristic pattern of clinical symptoms, clinical signs, and electrodiagnostic findings. The fundamental electrodiagnostic finding is partial conduction block of motor axons."

The AANEM (2004) approved a position statement, endorsed by the American Academy of Neurology and the American Academy of Physical Medicine & Rehabilitation, on diagnostic electromyography included the following[14,]:

- "Clinical needle electromyography (EMG) is an invasive medical procedure during which the physician inserts an electrode into a patient's muscles to diagnose the cause of muscle weakness. Needle EMG allows physicians to distinguish a wide range of conditions, from carpal tunnel syndrome to ALS (Lou Gehrig disease).
- Needle EMG is also an integral component of the neurological examination that cannot be separated from the physician's evaluation of the patient. The test is dynamic and depends upon the visual, tactile, and audio observations of the examiner. There is no way for physicians to independently verify the accuracy of reports performed by non-physicians.
- Misdiagnosis can mean delayed or inappropriate treatment (including surgery) and diminished quality of life. Because needle EMG is strictly diagnostic, the procedure clearly and exclusively falls within the practice of medicine."

The AANEM (2018) published a policy statement on the use of EMG for distal symmetric polyneuropathy.[16,] The statement described five situations in which EMG would be beneficial for patients with distal symmetric polyneuropathy: "1) determining primary and alternative diagnoses; 2) determining severity, duration, and prognosis of disease; 3) evaluating risk of associated problems; 4) determining the effect of medications; and 5) evaluating the effect of toxic exposures."

American Academy of Orthopaedic Surgeons

The American Academy of Orthopaedic Surgeons (2007) issued guidelines on the diagnosis of carpal tunnel syndrome.[13,] Table 5 lists recommendations made.

Table 5. Guidelines on Diagnosis of Carpal Tunnel Syndrome

No.	Recommendation	LOR	GOE
3.1a	"The physician may obtain electrodiagnostic tests to differentiate among diagnoses."	V	C
3.1b	"The physician may obtain electrodiagnostic tests in the presence of thenar atrophy and/or persistent numbness."	V	C
3.1c	"The physician should obtain electrodiagnostic tests if clinical and/or provocative tests are positive and surgical management is being considered."	II/III	B
3.2	"If the physician orders electrodiagnostic tests, the testing protocol should follow the AAN/AANEM/AAPMR guidelines for diagnosis of CTS."	IV/V	C

AANEM: American Association of Neuromuscular & Electrodiagnostic Medicine; AAN: American Academy of Neurology; AAPM&R: American Academy of Physical Medicine and Rehabilitation; CTS: carpal tunnel syndrome; GOE: grade of evidence; LOR: level of recommendation (II/III: "fair evidence"; IV/V: "poor quality evidence; V: "expert consensus").

North American Spine Society

The North American Spine Society (2012) published guidelines on the diagnosis and treatment of lumbar disc herniation.[9,] This document made the following statement about the use of EMG/NCS for diagnosis of lumbar disc herniation:

"Electromyography, nerve conduction studies and F-waves are suggested to have limited utility in the diagnosis of lumbar disc herniation with radiculopathy. H-reflexes can be helpful in the diagnosis of an S1 radiculopathy, though are not specific to the diagnosis of lumbar disc herniation. (Grade of Recommendation: B)"

U.S. Preventive Services Task Force Recommendations
Not applicable.

Ongoing and Unpublished Clinical Trials
A search of ClinicalTrials.gov in April 2019 did not identify any ongoing or unpublished trials that would likely influence this review.

CODING

The following codes for treatment and procedures applicable to this policy are included below for informational purposes. This may not be a comprehensive list of procedure codes applicable to this policy.

Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

The code(s) listed below are medically necessary ONLY if the procedure is performed according to the "Policy" section of this document.

CPT/HCPCS

95860	Needle electromyography; 1 extremity with or without related paraspinal areas
95861	Needle electromyography; 2 extremities with or without related paraspinal areas
95863	Needle electromyography; 3 extremities with or without related paraspinal areas
95864	Needle electromyography; 4 extremities with or without related paraspinal areas
95865	Needle electromyography; larynx
95866	Needle electromyography; hemidiaphragm
95867	Needle electromyography; cranial nerve supplied muscle(s), unilateral
95868	Needle electromyography; cranial nerve supplied muscle(s), bilateral
95869	Needle electromyography; thoracic paraspinal muscles (excluding T-1 or T-12)
95870	Needle electromyography; limited study of muscles in 1 ~~one~~ extremity or non-limb (axial) muscles (unilateral or bilateral), other than thoracic paraspinal, cranial nerve supplied muscles, or sphincters
95872	Needle electromyography using single fiber electrode, with quantitative measurement of jitter, blocking and/or fiber density, any/all sites of each muscle studied
95885	Needle electromyography, each extremity, with related paraspinal areas, when performed, done with nerve conduction, amplitude and latency/velocity study; limited (List separately in addition to code for primary procedure) (out of sequence)
95886	Needle electromyography, each extremity, with related paraspinal areas, when performed, done with nerve conduction, amplitude and latency/velocity study; complete, five or more muscles studies, innervated by three or more nerves or four or more spinal levels (List separately in addition to code for primary procedure) (out of sequence)
95887	Needle electromyography, non-extremity (cranial nerve supplied or axial) muscle(s) done with nerve conduction, amplitude and latency/velocity study (list separately in addition to code for primary procedure)
95907	Nerve conduction studies; 1-2 studies
95908	Nerve conduction studies; 3-4 studies

95909	Nerve conduction studies; 5-6 studies
95910	Nerve conduction studies; 7-8 studies
95911	Nerve conduction studies; 9-10 studies
95912	Nerve conduction studies; 11-12 studies
95913	Nerve conduction studies; 13 or more studies
95925	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in upper limbs
95926	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in lower limbs
95927	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in the trunk or head
95933	Orbicularis oculi (blink) reflex, by electrodiagnostic testing
95937	Neuromuscular junction testing (repetitive stimulation, paired stimuli), each nerve, any 1 method
95938	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in upper and lower limbs
95939	Central motor evoked potential study (transcranial motor stimulation); in upper and lower limbs
S3900	Surface electromyography (EMG)

ICD-10 Diagnoses

A52.15	Late syphilitic neuropathy
C70.1	Malignant neoplasm of spinal meninges
C72.0	Malignant neoplasm of spinal cord
C72.1	Malignant neoplasm of cauda equina
E08.41	Diabetes mellitus due to underlying condition with diabetic mononeuropathy
E08.42	Diabetes mellitus due to underlying condition with diabetic polyneuropathy
E08.43	Diabetes mellitus due to underlying condition with diabetic autonomic (poly)neuropathy
E08.44	Diabetes mellitus due to underlying condition with diabetic amyotrophy
E08.49	Diabetes mellitus due to underlying condition with other diabetic neurological complication
E08.610	Diabetes mellitus due to underlying condition with diabetic neuropathic arthropathy
E09.41	Drug or chemical induced diabetes mellitus with neurological complications with diabetic mononeuropathy
E09.42	Drug or chemical induced diabetes mellitus with neurological complications with diabetic polyneuropathy
E09.43	Drug or chemical induced diabetes mellitus with neurological complications with diabetic autonomic (poly)neuropathy
E09.44	Drug or chemical induced diabetes mellitus with neurological complications with diabetic amyotrophy
E09.49	Drug or chemical induced diabetes mellitus with neurological complications with other diabetic neurological complication
E09.610	Drug or chemical induced diabetes mellitus with diabetic neuropathic arthropathy
E10.41	Type 1 diabetes mellitus with diabetic mononeuropathy
E10.42	Type 1 diabetes mellitus with diabetic polyneuropathy
E10.43	Type 1 diabetes mellitus with diabetic autonomic (poly)neuropathy
E10.44	Type 1 diabetes mellitus with diabetic amyotrophy
E10.49	Type 1 diabetes mellitus with other diabetic neurological complication
E10.610	Type 1 diabetes mellitus with diabetic neuropathic arthropathy
E11.40	Type 2 diabetes mellitus with diabetic neuropathy, unspecified
E11.42	Type 2 diabetes mellitus with diabetic polyneuropathy

E11.44	Type 2 diabetes mellitus with diabetic amyotrophy
E13.41	Other specified diabetes mellitus with diabetic mononeuropathy
E13.42	Other specified diabetes mellitus with diabetic polyneuropathy
E13.43	Other specified diabetes mellitus with diabetic autonomic (poly)neuropathy
E13.44	Other specified diabetes mellitus with diabetic amyotrophy
E13.49	Other specified diabetes mellitus with other diabetic neurological complication
E13.610	Other specified diabetes mellitus with diabetic neuropathic arthropathy
E56.0	Deficiency of vitamin E
E56.8	Deficiency of other vitamins
E78.6	Lipoprotein deficiency
G12.0	Infantile spinal muscular atrophy, type I [Werdnig-Hoffman]
G12.1	Other inherited spinal muscular atrophy
G12.21	Amyotrophic lateral sclerosis
G12.22	Progressive bulbar palsy
G12.23	Primary lateral sclerosis
G12.24	Familial motor neuron disease
G12.25	Progressive spinal muscle atrophy
G12.29	Other motor neuron disease
G12.8	Other spinal muscular atrophies and related syndromes
G13.0	Paraneoplastic neuromyopathy and neuropathy
G13.1	Other systemic atrophy primarily affecting central nervous system in neoplastic disease
G24.1	Genetic torsion dystonia
G24.3	Spasmodic torticollis
G32.0	Subacute combined degeneration of spinal cord in diseases classified elsewhere
G36.0	Neuromyelitis optica [Devic]
G37.0	Diffuse sclerosis of central nervous system
G37.5	Concentric sclerosis [Balo] of central nervous system
G50.1	Atypical facial pain
G51.0	Bell's palsy
G51.2	Melkersson's syndrome
G51.31	Clonic hemifacial spasm, right
G51.32	Clonic hemifacial spasm, left
G51.33	Clonic hemifacial spasm, bilateral
G51.4	Facial myokymia
G51.8	Other disorders of facial nerve
G52.2	Disorders of vagus nerve
G52.3	Disorders of hypoglossal nerve
G52.7	Disorders of multiple cranial nerves
G52.8	Disorders of other specified cranial nerves
G54.0	Brachial plexus disorders
G54.1	Lumbosacral plexus disorders
G54.2	Cervical root disorders, not elsewhere classified
G54.3	Thoracic root disorders, not elsewhere classified
G54.4	Lumbosacral root disorders, not elsewhere classified
G54.5	Neuralgic amyotrophy
G54.6	Phantom limb syndrome with pain
G54.7	Phantom limb syndrome without pain
G54.8	Other nerve root and plexus disorders
G55	Nerve root and plexus compressions in diseases classified elsewhere
G56.01	Carpal tunnel syndrome, right upper limb
G56.02	Carpal tunnel syndrome, left upper limb

G56.11	Other lesions of median nerve, right upper limb
G56.12	Other lesions of median nerve, left upper limb
G56.21	Lesion of ulnar nerve, right upper limb
G56.22	Lesion of ulnar nerve, left upper limb
G56.31	Lesion of radial nerve, right upper limb
G56.32	Lesion of radial nerve, left upper limb
G56.41	Causalgia of right upper limb
G56.42	Causalgia of left upper limb
G56.81	Other specified mononeuropathies of right upper limb
G56.82	Other specified mononeuropathies of left upper limb
G57.01	Lesion of sciatic nerve, right lower limb
G57.02	Lesion of sciatic nerve, left lower limb
G57.11	Meralgia paresthetica, right lower limb
G57.12	Meralgia paresthetica, left lower limb
G57.21	Lesion of femoral nerve, right lower limb
G57.22	Lesion of femoral nerve, left lower limb
G57.31	Lesion of lateral popliteal nerve, right lower limb
G57.32	Lesion of lateral popliteal nerve, left lower limb
G57.41	Lesion of medial popliteal nerve, right lower limb
G57.42	Lesion of medial popliteal nerve, left lower limb
G57.51	Tarsal tunnel syndrome, right lower limb
G57.52	Tarsal tunnel syndrome, left lower limb
G57.61	Lesion of plantar nerve, right lower limb
G57.62	Lesion of plantar nerve, left lower limb
G57.71	Causalgia of right lower limb
G57.72	Causalgia of left lower limb
G57.81	Other specified mononeuropathies of right lower limb
G57.82	Other specified mononeuropathies of left lower limb
G58.0	Intercostal neuropathy
G58.7	Mononeuritis multiplex
G60.0	Hereditary motor and sensory neuropathy
G60.1	Refsum's disease
G60.2	Neuropathy in association with hereditary ataxia
G60.3	Idiopathic progressive neuropathy
G60.8	Other hereditary and idiopathic neuropathies
G61.0	Guillain-Barre syndrome
G61.1	Serum neuropathy
G61.81	Chronic inflammatory demyelinating polyneuritis
G61.89	Other inflammatory polyneuropathies
G62.0	Drug-induced polyneuropathy
G62.1	Alcoholic polyneuropathy
G62.2	Polyneuropathy due to other toxic agents
G62.81	Critical illness polyneuropathy
G62.82	Radiation-induced polyneuropathy
G62.89	Other specified polyneuropathies
G63	Polyneuropathy in diseases classified elsewhere
G64	Other disorders of peripheral nervous system
G65.0	Sequelae of Guillain-Barr ├⌐ syndrome
G65.1	Sequelae of other inflammatory polyneuropathy
G65.2	Sequelae of toxic polyneuropathy
G70.00	Myasthenia gravis without (acute) exacerbation

G70.01	Myasthenia gravis with (acute) exacerbation
G70.1	Toxic myoneural disorders
G70.2	Congenital and developmental myasthenia
G70.80	Lambert-Eaton syndrome, unspecified
G70.81	Lambert-Eaton syndrome in disease classified elsewhere
G70.89	Other specified myoneural disorders
G70.9	Myoneural disorder, unspecified
G71.01	Duchenne or Becker muscular dystrophy
G71.02	Facioscapulohumeral muscular dystrophy
G71.09	Other specified muscular dystrophies
G71.11	Myotonic muscular dystrophy
G71.12	Myotonia congenita
G71.13	Myotonic chondrodystrophy
G71.14	Drug induced myotonia
G71.19	Other specified myotonic disorders
G71.20	Congenital myopathy, unspecified
G71.21	Nemaline myopathy
G71.220	X-linked myotubular myopathy
G71.228	Other centronuclear myopathy
G71.29	Other congenital myopathy
G71.3	Mitochondrial myopathy, not elsewhere classified
G71.8	Other primary disorders of muscles
G72.0	Drug-induced myopathy
G72.1	Alcoholic myopathy
G72.2	Myopathy due to other toxic agents
G72.3	Periodic paralysis
G72.41	Inclusion body myositis [IBM]
G72.49	Other inflammatory and immune myopathies, not elsewhere classified
G72.81	Critical illness myopathy
G72.89	Other specified myopathies
G73.1	Lambert-Eaton syndrome in neoplastic disease
G73.3	Myasthenic syndromes in other diseases classified elsewhere
G73.7	Myopathy in diseases classified elsewhere
G83.4	Cauda equina syndrome
G83.81	Brown-S ├⌐quard syndrome
G83.82	Anterior cord syndrome
G83.83	Posterior cord syndrome
G83.84	Todd's paralysis (postepileptic)
G83.89	Other specified paralytic syndromes
G90.01	Carotid sinus syncope
G90.09	Other idiopathic peripheral autonomic neuropathy
G90.4	Autonomic dysreflexia
G95.0	Syringomyelia and syringobulbia
G95.11	Acute infarction of spinal cord (embolic) (nonembolic)
G95.19	Other vascular myelopathies
G95.81	Conus medullaris syndrome
G95.89	Other specified diseases of spinal cord
G99.0	Autonomic neuropathy in diseases classified elsewhere
G99.2	Myelopathy in diseases classified elsewhere
J38.01	Paralysis of vocal cords and larynx, unilateral
J38.02	Paralysis of vocal cords and larynx, bilateral

M05.411	Rheumatoid myopathy with rheumatoid arthritis of right shoulder
M05.412	Rheumatoid myopathy with rheumatoid arthritis of left shoulder
M05.421	Rheumatoid myopathy with rheumatoid arthritis of right elbow
M05.422	Rheumatoid myopathy with rheumatoid arthritis of left elbow
M05.431	Rheumatoid myopathy with rheumatoid arthritis of right wrist
M05.432	Rheumatoid myopathy with rheumatoid arthritis of left wrist
M05.441	Rheumatoid myopathy with rheumatoid arthritis of right hand
M05.442	Rheumatoid myopathy with rheumatoid arthritis of left hand
M05.451	Rheumatoid myopathy with rheumatoid arthritis of right hip
M05.452	Rheumatoid myopathy with rheumatoid arthritis of left hip
M05.461	Rheumatoid myopathy with rheumatoid arthritis of right knee
M05.462	Rheumatoid myopathy with rheumatoid arthritis of left knee
M05.471	Rheumatoid myopathy with rheumatoid arthritis of right ankle and foot
M05.472	Rheumatoid myopathy with rheumatoid arthritis of left ankle and foot
M05.49	Rheumatoid myopathy with rheumatoid arthritis of multiple sites
M05.511	Rheumatoid polyneuropathy with rheumatoid arthritis of right shoulder
M05.512	Rheumatoid polyneuropathy with rheumatoid arthritis of left shoulder
M05.521	Rheumatoid polyneuropathy with rheumatoid arthritis of right elbow
M05.522	Rheumatoid polyneuropathy with rheumatoid arthritis of left elbow
M05.531	Rheumatoid polyneuropathy with rheumatoid arthritis of right wrist
M05.532	Rheumatoid polyneuropathy with rheumatoid arthritis of left wrist
M05.541	Rheumatoid polyneuropathy with rheumatoid arthritis of right hand
M05.542	Rheumatoid polyneuropathy with rheumatoid arthritis of left hand
M05.551	Rheumatoid polyneuropathy with rheumatoid arthritis of right hip
M05.552	Rheumatoid polyneuropathy with rheumatoid arthritis of left hip
M05.561	Rheumatoid polyneuropathy with rheumatoid arthritis of right knee
M05.562	Rheumatoid polyneuropathy with rheumatoid arthritis of left knee
M05.571	Rheumatoid polyneuropathy with rheumatoid arthritis of right ankle and foot
M05.572	Rheumatoid polyneuropathy with rheumatoid arthritis of left ankle and foot
M05.59	Rheumatoid polyneuropathy with rheumatoid arthritis of multiple sites
M21.071	Valgus deformity, not elsewhere classified, right ankle
M21.072	Valgus deformity, not elsewhere classified, left ankle
M21.331	Wrist drop, right wrist
M21.332	Wrist drop, left wrist
M21.371	Foot drop, right foot
M21.372	Foot drop, left foot
M21.511	Acquired clawhand, right hand
M21.512	Acquired clawhand, left hand
M21.6x1	Other acquired deformities of right foot
M21.6x2	Other acquired deformities of left foot
M21.831	Other specified acquired deformities of right forearm
M21.832	Other specified acquired deformities of left forearm
M33.01	Juvenile dermatomyositis with respiratory involvement
M33.02	Juvenile dermatomyositis with myopathy
M33.09	Juvenile dermatomyositis with other organ involvement
M33.11	Other dermatomyositis with respiratory involvement
M33.12	Other dermatomyositis with myopathy
M33.19	Other dermatomyositis with other organ involvement
M33.21	Polymyositis with respiratory involvement
M33.22	Polymyositis with myopathy
M33.29	Polymyositis with other organ involvement

M33.91	Dermatopolymyositis, unspecified with respiratory involvement
M33.92	Dermatopolymyositis, unspecified with myopathy
M33.99	Dermatopolymyositis, unspecified with other organ involvement
M34.82	Systemic sclerosis with myopathy
M34.83	Systemic sclerosis with polyneuropathy
M35.03	Sjogren syndrome with myopathy (Effective 10-01-2021)
M35.05	Sjogren syndrome with inflammatory arthritis(Effective 10-01-2021)
M35.06	Sjogren syndrome with peripheral nervous system involvement(Effective 10-01-2021)
M35.07	Sjogren syndrome with central nervous system involvement(Effective 10-01-2021)
M35.08	Sjogren syndrome with central nervous system involvement(Effective 10-01-2021)
M35.8	Other specified systemic involvement of connective tissue(Effective 10-01-2021)
M36.0	Dermato(poly)myositis in neoplastic disease
M46.41	Discitis, unspecified, occipito-atlanto-axial region
M46.42	Discitis, unspecified, cervical region
M46.43	Discitis, unspecified, cervicothoracic region
M46.44	Discitis, unspecified, thoracic region
M46.45	Discitis, unspecified, thoracolumbar region
M46.46	Discitis, unspecified, lumbar region
M46.47	Discitis, unspecified, lumbosacral region
M47.011	Anterior spinal artery compression syndromes, occipito-atlanto-axial region
M47.012	Anterior spinal artery compression syndromes, cervical region
M47.013	Anterior spinal artery compression syndromes, cervicothoracic region
M47.014	Anterior spinal artery compression syndromes, thoracic region
M47.015	Anterior spinal artery compression syndromes, thoracolumbar region
M47.016	Anterior spinal artery compression syndromes, lumbar region
M47.019	Anterior spinal artery compression syndromes, site unspecified
M47.021	Vertebral artery compression syndromes, occipito-atlanto-axial region
M47.022	Vertebral artery compression syndromes, cervical region
M47.11	Other spondylosis with myelopathy, occipito-atlanto-axial region
M47.12	Other spondylosis with myelopathy, cervical region
M47.13	Other spondylosis with myelopathy, cervicothoracic region
M47.14	Other spondylosis with myelopathy, thoracic region
M47.15	Other spondylosis with myelopathy, thoracolumbar region
M47.16	Other spondylosis with myelopathy, lumbar region
M47.17	Other spondylosis with myelopathy, lumbosacral region
M47.18	Other spondylosis with myelopathy, sacral and sacrococcygeal region
M47.21	Other spondylosis with radiculopathy, occipito-atlanto-axial region
M47.22	Other spondylosis with radiculopathy, cervical region
M47.23	Other spondylosis with radiculopathy, cervicothoracic region
M47.24	Other spondylosis with radiculopathy, thoracic region
M47.25	Other spondylosis with radiculopathy, thoracolumbar region
M47.26	Other spondylosis with radiculopathy, lumbar region
M47.27	Other spondylosis with radiculopathy, lumbosacral region
M47.28	Other spondylosis with radiculopathy, sacral and sacrococcygeal region
M47.811	Spondylosis without myelopathy or radiculopathy, occipito-atlanto-axial region
M47.812	Spondylosis without myelopathy or radiculopathy, cervical region
M47.813	Spondylosis without myelopathy or radiculopathy, cervicothoracic region
M47.814	Spondylosis without myelopathy or radiculopathy, thoracic region
M47.815	Spondylosis without myelopathy or radiculopathy, thoracolumbar region
M47.816	Spondylosis without myelopathy or radiculopathy, lumbar region
M47.817	Spondylosis without myelopathy or radiculopathy, lumbosacral region

M47.818	Spondylosis without myelopathy or radiculopathy, sacral and sacrococcygeal region
M47.891	Other spondylosis, occipito-atlanto-axial region
M47.892	Other spondylosis, cervical region
M47.893	Other spondylosis, cervicothoracic region
M47.894	Other spondylosis, thoracic region
M47.895	Other spondylosis, thoracolumbar region
M47.896	Other spondylosis, lumbar region
M47.897	Other spondylosis, lumbosacral region
M47.898	Other spondylosis, sacral and sacrococcygeal region
M48.01	Spinal stenosis, occipito-atlanto-axial region
M48.02	Spinal stenosis, cervical region
M48.03	Spinal stenosis, cervicothoracic region
M48.04	Spinal stenosis, thoracic region
M48.05	Spinal stenosis, thoracolumbar region
M48.061	Spinal stenosis, lumbar region without neurogenic claudication
M48.062	Spinal stenosis, lumbar region with neurogenic claudication
M48.07	Spinal stenosis, lumbosacral region
M48.08	Spinal stenosis, sacral and sacrococcygeal region
M50.01	Cervical disc disorder with myelopathy, occipito-atlanto-axial region
M50.02	Cervical disc disorder with myelopathy, mid-cervical region
M50.03	Cervical disc disorder with myelopathy, cervicothoracic region
M50.11	Cervical disc disorder with radiculopathy, occipito-atlanto-axial region
M50.12	Cervical disc disorder with radiculopathy, mid-cervical region
M50.13	Cervical disc disorder with radiculopathy, cervicothoracic region
M50.21	Other cervical disc displacement, occipito-atlanto-axial region
M50.22	Other cervical disc displacement, mid-cervical region
M50.23	Other cervical disc displacement, cervicothoracic region
M50.31	Other cervical disc degeneration, occipito-atlanto-axial region
M50.32	Other cervical disc degeneration, mid-cervical region
M50.33	Other cervical disc degeneration, cervicothoracic region
M50.81	Other cervical disc disorders, occipito-atlanto-axial region
M50.82	Other cervical disc disorders, mid-cervical region
M50.83	Other cervical disc disorders, cervicothoracic region
M50.91	Cervical disc disorder, unspecified, occipito-atlanto-axial region
M50.92	Cervical disc disorder, unspecified, mid-cervical region
M50.93	Cervical disc disorder, unspecified, cervicothoracic region
M51.04	Intervertebral disc disorders with myelopathy, thoracic region
M51.05	Intervertebral disc disorders with myelopathy, thoracolumbar region
M51.06	Intervertebral disc disorders with myelopathy, lumbar region
M51.07	Intervertebral disc disorders with myelopathy, lumbosacral region
M51.24	Other intervertebral disc displacement, thoracic region
M51.25	Other intervertebral disc displacement, thoracolumbar region
M51.26	Other intervertebral disc displacement, lumbar region
M51.27	Other intervertebral disc displacement, lumbosacral region
M51.34	Other intervertebral disc degeneration, thoracic region
M51.35	Other intervertebral disc degeneration, thoracolumbar region
M51.36	Other intervertebral disc degeneration, lumbar region
M51.37	Other intervertebral disc degeneration, lumbosacral region
M51.84	Other intervertebral disc disorders, thoracic region
M51.85	Other intervertebral disc disorders, thoracolumbar region
M51.86	Other intervertebral disc disorders, lumbar region

M51.87	Other intervertebral disc disorders, lumbosacral region
M54.10	Radiculopathy, site unspecified
M54.11	Radiculopathy, occipito-atlanto-axial region
M54.12	Radiculopathy, cervical region
M54.13	Radiculopathy, cervicothoracic region
M54.18	Radiculopathy, sacral and sacrococcygeal region
M54.31	Sciatica, right side
M54.32	Sciatica, left side
M54.41	Lumbago with sciatica, right side
M54.42	Lumbago with sciatica, left side
~~M54.5~~	~~Low back pain~~
M54.50	Low back pain, unspecified (Effective 10-01-2021)
M54.51	Vertebrogenic low back pain (Effective 10-01-2021)
M54.59	Other low back pain (Effective 10-01-2021)
M54.6	Pain in thoracic spine
M60.011	Infective myositis, right shoulder
M60.012	Infective myositis, left shoulder
M60.021	Infective myositis, right upper arm
M60.022	Infective myositis, left upper arm
M60.031	Infective myositis, right forearm
M60.032	Infective myositis, left forearm
M60.041	Infective myositis, right hand
M60.042	Infective myositis, left hand
M60.044	Infective myositis, right finger(s)
M60.045	Infective myositis, left finger(s)
M60.051	Infective myositis, right thigh
M60.052	Infective myositis, left thigh
M60.061	Infective myositis, right lower leg
M60.062	Infective myositis, left lower leg
M60.070	Infective myositis, right ankle
M60.071	Infective myositis, left ankle
M60.073	Infective myositis, right foot
M60.074	Infective myositis, left foot
M60.076	Infective myositis, right toe(s)
M60.077	Infective myositis, left toe(s)
M60.08	Infective myositis, other site
M60.09	Infective myositis, multiple sites
M79.2	Neuralgia and neuritis, unspecified
M79.601	Pain in right arm
M79.602	Pain in left arm
M79.604	Pain in right leg
M79.605	Pain in left leg
M79.621	Pain in right upper arm
M79.622	Pain in left upper arm
M79.631	Pain in right forearm
M79.632	Pain in left forearm
M79.641	Pain in right hand
M79.642	Pain in left hand
M79.644	Pain in right finger(s)
M79.645	Pain in left finger(s)
M79.651	Pain in right thigh

M79.652	Pain in left thigh
M79.661	Pain in right lower leg
M79.662	Pain in left lower leg
M79.671	Pain in right foot
M79.672	Pain in left foot
M79.674	Pain in right toe(s)
M79.675	Pain in left toe(s)
M96.1	Post laminectomy syndrome, not elsewhere classified
M99.20	Subluxation stenosis of neural canal of head region
M99.21	Subluxation stenosis of neural canal of cervical region
M99.22	Subluxation stenosis of neural canal of thoracic region
M99.23	Subluxation stenosis of neural canal of lumbar region
M99.24	Subluxation stenosis of neural canal of sacral region
M99.25	Subluxation stenosis of neural canal of pelvic region
M99.26	Subluxation stenosis of neural canal of lower extremity
M99.27	Subluxation stenosis of neural canal of upper extremity
M99.28	Subluxation stenosis of neural canal of rib cage
M99.29	Subluxation stenosis of neural canal of abdomen and other regions
M99.30	Osseous stenosis of neural canal of head region
M99.31	Osseous stenosis of neural canal of cervical region
M99.32	Osseous stenosis of neural canal of thoracic region
M99.33	Osseous stenosis of neural canal of lumbar region
M99.34	Osseous stenosis of neural canal of sacral region
M99.35	Osseous stenosis of neural canal of pelvic region
M99.36	Osseous stenosis of neural canal of lower extremity
M99.37	Osseous stenosis of neural canal of upper extremity
M99.38	Osseous stenosis of neural canal of rib cage
M99.39	Osseous stenosis of neural canal of abdomen and other regions
M99.40	Connective tissue stenosis of neural canal of head region
M99.41	Connective tissue stenosis of neural canal of cervical region
M99.42	Connective tissue stenosis of neural canal of thoracic region
M99.43	Connective tissue stenosis of neural canal of lumbar region
M99.44	Connective tissue stenosis of neural canal of sacral region
M99.45	Connective tissue stenosis of neural canal of pelvic region
M99.46	Connective tissue stenosis of neural canal of lower extremity
M99.47	Connective tissue stenosis of neural canal of upper extremity
M99.48	Connective tissue stenosis of neural canal of rib cage
M99.49	Connective tissue stenosis of neural canal of abdomen and other regions
M99.50	Intervertebral disc stenosis of neural canal of head region
M99.51	Intervertebral disc stenosis of neural canal of cervical region
M99.52	Intervertebral disc stenosis of neural canal of thoracic region
M99.53	Intervertebral disc stenosis of neural canal of lumbar region
M99.54	Intervertebral disc stenosis of neural canal of sacral region
M99.55	Intervertebral disc stenosis of neural canal of pelvic region
M99.56	Intervertebral disc stenosis of neural canal of lower extremity
M99.57	Intervertebral disc stenosis of neural canal of upper extremity
M99.58	Intervertebral disc stenosis of neural canal of rib cage
M99.59	Intervertebral disc stenosis of neural canal of abdomen and other regions
M99.60	Osseous and subluxation stenosis of intervertebral foramina of head region
M99.61	Osseous and subluxation stenosis of intervertebral foramina of cervical region
M99.62	Osseous and subluxation stenosis of intervertebral foramina of thoracic region

M99.63	Osseous and subluxation stenosis of intervertebral foramina of lumbar region
M99.64	Osseous and subluxation stenosis of intervertebral foramina of sacral region
M99.65	Osseous and subluxation stenosis of intervertebral foramina of pelvic region
M99.66	Osseous and subluxation stenosis of intervertebral foramina of lower extremity
M99.67	Osseous and subluxation stenosis of intervertebral foramina of upper extremity
M99.68	Osseous and subluxation stenosis of intervertebral foramina of rib cage
M99.69	Osseous and subluxation stenosis of intervertebral foramina of abdomen and other regions
M99.70	Connective tissue and disc stenosis of intervertebral foramina of head region
M99.71	Connective tissue and disc stenosis of intervertebral foramina of cervical region
M99.72	Connective tissue and disc stenosis of intervertebral foramina of thoracic region
M99.73	Connective tissue and disc stenosis of intervertebral foramina of lumbar region
M99.74	Connective tissue and disc stenosis of intervertebral foramina of sacral region
M99.75	Connective tissue and disc stenosis of intervertebral foramina of pelvic region
M99.76	Connective tissue and disc stenosis of intervertebral foramina of lower extremity
M99.77	Connective tissue and disc stenosis of intervertebral foramina of upper extremity
M99.78	Connective tissue and disc stenosis of intervertebral foramina of rib cage
M99.79	Connective tissue and disc stenosis of intervertebral foramina of abdomen and other regions
N39.3	Stress incontinence (female) (male)
N39.41	Urge incontinence
N39.42	Incontinence without sensory awareness
N39.43	Post-void dribbling
N39.44	Nocturnal enuresis
N39.45	Continuous leakage
N39.46	Mixed incontinence
R20.0	Anesthesia of skin
R20.1	Hypoesthesia of skin
R20.2	Paresthesia of skin
R20.3	Hyperesthesia
R20.8	Other disturbances of skin sensation
R29.0	Tetany
R29.5	Transient paralysis
R39.14	Feeling of incomplete bladder emptying
R49.8	Other voice and resonance disorders

The following ICD-10 codes represent the initial encounter only. The subsequent encounter and sequela are applicable to this policy. Use the 7th character D for subsequent counter or S for sequela when indicated.

S14.0xxA	Concussion and edema of cervical spinal cord, initial encounter
S14.105A	Unspecified injury at C5 level of cervical spinal cord, initial encounter
S14.106A	Unspecified injury at C6 level of cervical spinal cord, initial encounter
S14.107A	Unspecified injury at C7 level of cervical spinal cord, initial encounter
S14.108A	Unspecified injury at C8 level of cervical spinal cord, initial encounter
S14.111A	Complete lesion at C1 level of cervical spinal cord, initial encounter
S14.112A	Complete lesion at C2 level of cervical spinal cord, initial encounter
S14.113A	Complete lesion at C3 level of cervical spinal cord, initial encounter
S14.114A	Complete lesion at C4 level of cervical spinal cord, initial encounter
S14.115A	Complete lesion at C5 level of cervical spinal cord, initial encounter
S14.116A	Complete lesion at C6 level of cervical spinal cord, initial encounter
S14.117A	Complete lesion at C7 level of cervical spinal cord, initial encounter
S14.118A	Complete lesion at C8 level of cervical spinal cord, initial encounter
S14.121A	Central cord syndrome at C1 level of cervical spinal cord, initial encounter

S14.122A Central cord syndrome at C2 level of cervical spinal cord, initial encounter
S14.123A Central cord syndrome at C3 level of cervical spinal cord, initial encounter
S14.124A Central cord syndrome at C4 level of cervical spinal cord, initial encounter
S14.125A Central cord syndrome at C5 level of cervical spinal cord, initial encounter
S14.126A Central cord syndrome at C6 level of cervical spinal cord, initial encounter
S14.127A Central cord syndrome at C7 level of cervical spinal cord, initial encounter
S14.128A Central cord syndrome at C8 level of cervical spinal cord, initial encounter
S14.131A Anterior cord syndrome at C1 level of cervical spinal cord, initial encounter
S14.132A Anterior cord syndrome at C2 level of cervical spinal cord, initial encounter
S14.133A Anterior cord syndrome at C3 level of cervical spinal cord, initial encounter
S14.134A Anterior cord syndrome at C4 level of cervical spinal cord, initial encounter
S14.135A Anterior cord syndrome at C5 level of cervical spinal cord, initial encounter
S14.136A Anterior cord syndrome at C6 level of cervical spinal cord, initial encounter
S14.137A Anterior cord syndrome at C7 level of cervical spinal cord, initial encounter
S14.138A Anterior cord syndrome at C8 level of cervical spinal cord, initial encounter
S14.141A Brown-Sequard syndrome at C1 level of cervical spinal cord, initial encounter
S14.142A Brown-Sequard syndrome at C2 level of cervical spinal cord, initial encounter
S14.143A Brown-Sequard syndrome at C3 level of cervical spinal cord, initial encounter
S14.144A Brown-Sequard syndrome at C4 level of cervical spinal cord, initial encounter
S14.145A Brown-Sequard syndrome at C5 level of cervical spinal cord, initial encounter
S14.146A Brown-Sequard syndrome at C6 level of cervical spinal cord, initial encounter
S14.147A Brown-Sequard syndrome at C7 level of cervical spinal cord, initial encounter
S14.148A Brown-Sequard syndrome at C8 level of cervical spinal cord, initial encounter
S14.151A Other incomplete lesion at C1 level of cervical spinal cord, initial encounter
S14.152A Other incomplete lesion at C2 level of cervical spinal cord, initial encounter
S14.153A Other incomplete lesion at C3 level of cervical spinal cord, initial encounter
S14.154A Other incomplete lesion at C4 level of cervical spinal cord, initial encounter
S14.155A Other incomplete lesion at C5 level of cervical spinal cord, initial encounter
S14.156A Other incomplete lesion at C6 level of cervical spinal cord, initial encounter
S14.157A Other incomplete lesion at C7 level of cervical spinal cord, initial encounter
S14.158A Other incomplete lesion at C8 level of cervical spinal cord, initial encounter
S14.2xxA Injury of nerve root of cervical spine, initial encounter
S14.3xxA Injury of brachial plexus, initial encounter
S14.5xxA Injury of cervical sympathetic nerves, initial encounter
S24.0xxA Concussion and edema of thoracic spinal cord, initial encounter
S24.101A Unspecified injury at T1 level of thoracic spinal cord, initial encounter
S24.102A Unspecified injury at T2-T6 level of thoracic spinal cord, initial encounter
S24.103A Unspecified injury at T7-T10 level of thoracic spinal cord, initial encounter
S24.104A Unspecified injury at T11-T12 level of thoracic spinal cord, initial encounter
S24.111A Complete lesion at T1 level of thoracic spinal cord, initial encounter
S24.112A Complete lesion at T2-T6 level of thoracic spinal cord, initial encounter
S24.113A Complete lesion at T7-T10 level of thoracic spinal cord, initial encounter
S24.114A Complete lesion at T11-T12 level of thoracic spinal cord, initial encounter
S24.131A Anterior cord syndrome at T1 level of thoracic spinal cord, initial encounter
S24.132A Anterior cord syndrome at T2-T6 level of thoracic spinal cord, initial encounter
S24.133A Anterior cord syndrome at T7-T10 level of thoracic spinal cord, initial encounter
S24.134A Anterior cord syndrome at T11-T12 level of thoracic spinal cord, initial encounter
S24.141A Brown-Sequard syndrome at T1 level of thoracic spinal cord, initial encounter
S24.142A Brown-Sequard syndrome at T2-T6 level of thoracic spinal cord, initial encounter
S24.143A Brown-Sequard syndrome at T7-T10 level of thoracic spinal cord, initial encounter
S24.144A Brown-Sequard syndrome at T11-T12 level of thoracic spinal cord, initial encounter

S24.151A Other incomplete lesion at T1 level of thoracic spinal cord, initial encounter
S24.152A Other incomplete lesion at T2-T6 level of thoracic spinal cord, initial encounter
S24.153A Other incomplete lesion at T7-T10 level of thoracic spinal cord, initial encounter
S24.154A Other incomplete lesion at T11-T12 level of thoracic spinal cord, initial encounter
S24.2xxA Injury of nerve root of thoracic spine, initial encounter
S24.3xxA Injury of peripheral nerves of thorax, initial encounter
S24.4xxA Injury of thoracic sympathetic nervous system, initial encounter
S24.8xxA Injury of other specified nerves of thorax, initial encounter
S34.01xA Concussion and edema of lumbar spinal cord, initial encounter
S34.02xA Concussion and edema of sacral spinal cord, initial encounter
S34.101A Unspecified injury to L1 level of lumbar spinal cord, initial encounter
S34.102A Unspecified injury to L2 level of lumbar spinal cord, initial encounter
S34.103A Unspecified injury to L3 level of lumbar spinal cord, initial encounter
S34.104A Unspecified injury to L4 level of lumbar spinal cord, initial encounter
S34.105A Unspecified injury to L5 level of lumbar spinal cord, initial encounter
S34.111A Complete lesion of L1 level of lumbar spinal cord, initial encounter
S34.112A Complete lesion of L2 level of lumbar spinal cord, initial encounter
S34.113A Complete lesion of L3 level of lumbar spinal cord, initial encounter
S34.114A Complete lesion of L4 level of lumbar spinal cord, initial encounter
S34.115A Complete lesion of L5 level of lumbar spinal cord, initial encounter
S34.121A Incomplete lesion of L1 level of lumbar spinal cord, initial encounter
S34.122A Incomplete lesion of L2 level of lumbar spinal cord, initial encounter
S34.123A Incomplete lesion of L3 level of lumbar spinal cord, initial encounter
S34.124A Incomplete lesion of L4 level of lumbar spinal cord, initial encounter
S34.125A Incomplete lesion of L5 level of lumbar spinal cord, initial encounter
S34.131A Complete lesion of sacral spinal cord, initial encounter
S34.132A Incomplete lesion of sacral spinal cord, initial encounter
S34.139A Unspecified injury to sacral spinal cord, initial encounter
S34.21xA Injury of nerve root of lumbar spine, initial encounter
S34.22xA Injury of nerve root of sacral spine, initial encounter
S34.3xxA Injury of cauda equina, initial encounter
S34.4xxA Injury of lumbosacral plexus, initial encounter
S34.5xxA Injury of lumbar, sacral and pelvic sympathetic nerves, initial encounter
S34.6xxA Injury of peripheral nerve(s) at abdomen, lower back and pelvis level, initial encounter
S34.8xxA Injury of other nerves at abdomen, lower back and pelvis level, initial encounter
S44.01xA Injury of ulnar nerve at upper arm level, right arm, initial encounter
S44.02xA Injury of ulnar nerve at upper arm level, left arm, initial encounter
S44.11xA Injury of median nerve at upper arm level, right arm, initial encounter
S44.12xA Injury of median nerve at upper arm level, left arm, initial encounter
S44.21xA Injury of radial nerve at upper arm level, right arm, initial encounter
S44.22xA Injury of radial nerve at upper arm level, left arm, initial encounter
S44.31xA Injury of axillary nerve, right arm, initial encounter
S44.32xA Injury of axillary nerve, left arm, initial encounter
S44.41xA Injury of musculocutaneous nerve, right arm, initial encounter
S44.42xA Injury of musculocutaneous nerve, left arm, initial encounter
S44.51xA Injury of cutaneous sensory nerve at shoulder and upper arm level, right arm, initial encounter
S44.52xA Injury of cutaneous sensory nerve at shoulder and upper arm level, left arm, initial encounter
S44.8x1A Injury of other nerves at shoulder and upper arm level, right arm, initial encounter
S44.8x2A Injury of other nerves at shoulder and upper arm level, left arm, initial encounter
S54.01xA Injury of ulnar nerve at forearm level, right arm, initial encounter

S54.02xA Injury of ulnar nerve at forearm level, left arm, initial encounter
S54.11xA Injury of median nerve at forearm level, right arm, initial encounter
S54.12xA Injury of median nerve at forearm level, left arm, initial encounter
S54.21xA Injury of radial nerve at forearm level, right arm, initial encounter
S54.22xA Injury of radial nerve at forearm level, left arm, initial encounter
S54.31xA Injury of cutaneous sensory nerve at forearm level, right arm, initial encounter
S54.32xA Injury of cutaneous sensory nerve at forearm level, left arm, initial encounter
S54.8x1A Unspecified injury of other nerves at forearm level, right arm, initial encounter
S54.8x2A Unspecified injury of other nerves at forearm level, left arm, initial encounter
S64.01xA Injury of ulnar nerve at wrist and hand level of right arm, initial encounter
S64.02xA Injury of ulnar nerve at wrist and hand level of left arm, initial encounter
S64.11xA Injury of median nerve at wrist and hand level of right arm, initial encounter
S64.12xA Injury of median nerve at wrist and hand level of left arm, initial encounter
S64.21xA Injury of radial nerve at wrist and hand level of right arm, initial encounter
S64.22xA Injury of radial nerve at wrist and hand level of left arm, initial encounter
S64.31xA Injury of digital nerve of right thumb, initial encounter
S64.32xA Injury of digital nerve of left thumb, initial encounter
S64.490A Injury of digital nerve of right index finger, initial encounter
S64.491A Injury of digital nerve of left index finger, initial encounter
S64.492A Injury of digital nerve of right middle finger, initial encounter
S64.493A Injury of digital nerve of left middle finger, initial encounter
S64.494A Injury of digital nerve of right ring finger, initial encounter
S64.495A Injury of digital nerve of left ring finger, initial encounter
S64.496A Injury of digital nerve of right little finger, initial encounter
S64.497A Injury of digital nerve of left little finger, initial encounter
S64.8x1A Injury of other nerves at wrist and hand level of right arm, initial encounter
S64.8x2A Injury of other nerves at wrist and hand level of left arm, initial encounter
S74.01xA Injury of sciatic nerve at hip and thigh level, right leg, initial encounter
S74.02xA Injury of sciatic nerve at hip and thigh level, left leg, initial encounter
S74.11xA Injury of femoral nerve at hip and thigh level, right leg, initial encounter
S74.12xA Injury of femoral nerve at hip and thigh level, left leg, initial encounter
S74.21xA Injury of cutaneous sensory nerve at hip and high level, right leg, initial encounter
S74.22xA Injury of cutaneous sensory nerve at hip and thigh level, left leg, initial encounter
S74.8x1A Injury of other nerves at hip and thigh level, right leg, initial encounter
S74.8x2A Injury of other nerves at hip and thigh level, left leg, initial encounter
S84.01xA Injury of tibial nerve at lower leg level, right leg, initial encounter
S84.02xA Injury of tibial nerve at lower leg level, left leg, initial encounter
S84.11xA Injury of peroneal nerve at lower leg level, right leg, initial encounter
S84.12xA Injury of peroneal nerve at lower leg level, left leg, initial encounter
S84.21xA Injury of cutaneous sensory nerve at lower leg level, right leg, initial encounter
S84.22xA Injury of cutaneous sensory nerve at lower leg level, left leg, initial encounter
S84.801A Injury of other nerves at lower leg level, right leg, initial encounter
S84.802A Injury of other nerves at lower leg level, left leg, initial encounter
S94.01xA Injury of lateral plantar nerve, right leg, initial encounter
S94.02xA Injury of lateral plantar nerve, left leg, initial encounter
S94.11xA Injury of medial plantar nerve, right leg, initial encounter
S94.12xA Injury of medial plantar nerve, left leg, initial encounter
S94.21xA Injury of deep peroneal nerve at ankle and foot level, right leg, initial encounter
S94.22xA Injury of deep peroneal nerve at ankle and foot level, left leg, initial encounter
S94.31xA Injury of cutaneous sensory nerve at ankle and foot level, right leg, initial encounter
S94.32xA Injury of cutaneous sensory nerve at ankle and foot level, left leg, initial encounter

S94.8x1A Injury of other nerves at ankle and foot level, right leg, initial encounter
S94.8x2A Injury of other nerves at ankle and foot level, left leg, initial encounter

REVISIONS	
11-12-2008	In Header section: ▪ Replaced previous title of "Electrodiagnostic (EDX) Medicine and Related Services" with current title.
	In Description section: ▪ Expanded to include definition of electrodiagnostic medicine and provided descriptions for identified services.
	In Policy section regarding #1 through #12: ▪ Removed the following: 1. EDX testing should be medically indicated. EDX examinations include history taking, appropriate physical examination, and the design, performance, and interpretation of EDX studies. 3. The number of tests performed should be the minimum needed to establish an accurate diagnosis. 4. A specialty-trained provider should perform NCS. 5. A provider specialty trained in electrodiagnostic medicine must perform the needle EMG examination as these tests are simultaneously performed and interpreted. 8. Examination using portable hand-held devices, which are incapable of waveform analysis, will not be paid. Equipment shall have FDA clearance for performance of nerve conductions studies. The device must be capable of electrically stimulating a nerve and recording the resultant response at a second location on that nerve (sensory study) and /or in a muscle innervated by the stimulated nerve (motor study). Psychophysical measurements (current, vibration, and thermal perceptions) even though they may involve delivery of a stimulus, are not recognized for payment. 10. Determining the proper number of units for nerve conductions has always been a challenge. The AANEM worked with the American Medical Association (AMA) and the American Academy of Neurology (AAN) to create a list of nerves to assist physicians and billing departments to clarify the specific nerves that can be billed for nerve conduction studies. Each study on the list qualifies as one unit for nerve conduction studies (95900, 95903 and 95904). 11. For list of Maximum Number of Studies refer to AANEM web site, http://www.aanem.org/practiceissues/recPolicy/recommended_policy_6.cfm 12. For List of Nerves with Added Specificity refer to AANEM web site, http://www.aanem.org/practiceissues/recPolicy/listofNerves.cfm ▪ Replaced, "6. EDX unit limits are discussed in the 'Coding' section of this document. When exceeding the normal unit limit, the provider should use modifier 22 and submit supplementary documentation to justify the additional testing (American Association of Neuromuscular and Electrodiagnostic Medicine [AANEM] estimates this may occur in 10% of cases). Additional testing may be indicated in patients with a differential diagnosis, which includes peripheral neuropathy, cervical radiculopathy, brachial plexopathy, or more proximal median neuropathy." with current #1. ▪ Added AANEM Recommended Maximum Number of Studies chart. ▪ Added Maximum Number of Studies for Additional Codes chart. ▪ Previous #7 became current #2. ▪ Added new #3.
	▪ Previous #2 and #9 became current #1 and #3 in Policy Guideline subsection. ▪ The following wording from previous #6 "When exceeding the normal unit limit, the provider should use modifier 22 and submit supplementary documentation to justify the additional testing AANEM estimates this may occur in 10% of cases)" became current #2 in Policy Guideline subsection.

	▪ Removed Documentation subsection which stated: 1. Documentation should explain what differential diagnostic problems needed to be ruled out in that particular situation. In some patients, multiple diagnoses will be established by EDX testing. It should be noted that in some situations it is necessary to test an asymptomatic contralateral limb to establish normative values for an individual patient. Normal values based on the general population alone are less sensitive than this approach; therefore restrictions on contralateral asymptomatic limb testing will reduce the sensitivity of electrodiagnostic tests. 2. Contralateral (bilateral) extremity counterparts may be billed separately as noted in the Blink Reflexes section. Contralateral means opposite sides of the body, not opposite sides of an extremity. When billing, indicate right (RT) and left (LT). 3. Any services exceeding the unit limit listed by the code must be submitted with medical record documentation to support medical necessity of increased units. Professional providers should report modifier 22. ▪ Removed from Utilization subsection: 1. Units exceeding the unit maximum must have medical records submitted with the claims or the additional units will be denied. Professional providers should report modifier 22. 2c. Polymyositis and myasthenia gravis and other such diseases usually have a course that is not stable and do not respond to treatment consistently; in these cases monitoring of the patient's condition may be needed to monitor disease progress and therapeutic intervention responses. 2d. It may be necessary to retest when a course of a disease changes unexpectedly. ▪ In Utilization subsection 2b. replaced "early treatment to begin with preliminary testing with additional testing for prognosis and status of patient." with "monitoring patient progress." ▪ In Utilization subsection 3 replaced "Repeat EDX is sometimes necessary and when supported by medical documentation will be allowed. The claim must be submitted with medical record documentation to support medical necessity of repeat testing. Professional providers should report modifier 22. Common frequency testing for these diagnosis for a 12 month period, per provider are: a. Two (2) tests - Carpal tunnel-unilateral, carpal tunnel-bilateral, radiculopathy, mononeuropathy, poly–neuropathy, myopathy, and neuromuscular junction (NMJ) disorders. b. Three (3) tests - Motor neuronopathy and plexopathy." with "The claim must be submitted with medical record documentation to support medical necessity of repeat testing. Professional providers should report modifier 22."
	In Coding section: ▪ Replaced Code/Unit charts reflecting descriptions, units, guidelines, and comments with traditional CPT/HCPCS nomenclature. ▪ Units for codes 95860-95864, 95867-95870, 95900, 95903, 95904, 95934, 95936, and 95937 were updated to be in accordance with AANEM guidelines and reflected in the AANEM Recommended Maximum Number of Studies chart. ▪ Units for codes 95865, 95866, 95872, 95921, 95922, 95923, 95925, 95926, 95927, and 95933 were unchanged and reflected in the Maximum Number of Studies for Additional Codes chart. ▪ Replaced individual diagnosis codes with code ranges where applicable. No CPT/HCPCS or Diagnosis codes were removed or added.\
03-13-2012	In Coding section: ▪ Added CPT codes: 95885, 95886, 95887, 95938, 95939 (effective 01-01-2012)
04-12-2013	In Description section: Removed "Autonomic nervous system function testing - The purpose of autonomic nervous system function testing is to determine the presence of autonomic dysfunction, the site of autonomic dysfunction, and the various autonomic systems that may be disordered." as this information was erroneously in the policy.

	In Policy section: ▪ Revised wording of Item 1 from, "Electromyography and Nerve Conduction Studies are medically necessary as referenced in the AANEM (American Association of Neuromuscular and Electrodiagnostic Medicine) Maximum Number of Studies and Maximum Number of Studies for Additional Codes charts." to, "1. Electromyography and Nerve Conduction Studies are medically necessary as referenced in the following charts: Chart A - Type of Study / Maximum Number of Studies Chart B - Nerve Conduction Studies, and Chart C - Maximum Number of Studies for Additional Codes" ▪ Renamed the chart titled, "AANEM Recommended Maximum Number of Studies" to "Type of Study / Maximum Number of Studies". Updated chart and labeled Chart A. ▪ Added Chart B, Nerve Conduction Studies. ▪ Updated Maximum Number of Studies for Additional Codes chart and labeled Chart C. ▪ In Policy Guidelines removed, "2. When exceeding the allowed unit limit, the professional provider should use modifier 22 and submit supplementary documentation to justify the additional testing (AANEM estimates this may occur in 10% of cases)." as this information was located in the Utilization subsection. ▪ In the Policy Guidelines removed, "3. In 2006, the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) issued a position statement that illustrates how standardized nerve conduction studies performed independent of needle EMG studies may miss data essential for an accurate diagnosis and how nerve disorders are far more likely to be misdiagnosed or missed completely if a practitioner without the proper skill and training is interpreting the data, making a diagnosis, and establishing a treatment plan. (21) The organization states that, “the standard of care in clinical practice dictates that using a predetermined or standardized battery of NCSs for all patients is inappropriate,” and concludes that, “It is the position of the AANEM that, except in unique situations, NCSs and needle EMG should be performed together in a study design determined by a trained neuromuscular physician.” ▪ In the Policy Guidelines added, "2. Like the Wisconsin Physicians Service (WPS), Blue Cross and Blue Shield of Kansas expects healthcare professionals who perform electrodiagnostic (ED) testing will be appropriately trained and/or credentialed, either by a formal residency/fellowship program, certification by a nationally recognized organization, or by an accredited post-graduate training course covering anatomy, neurophysiology and forms of electrodiagnostics (including both NCS and EMG), in order to provide the proper testing and assessment of the patient's condition, and appropriate safety measures. It would be highly unlikely that this training and/or credentialing is possessed by providers other than Neurologists, or Physical Medicine & Rehabilitation physicians. 3. The electrodiagnostic evaluation is an extension of the neurologic portion of the physical examination. Both require a detailed knowledge of a patient and his/her disease. Training in the performance of electrodiagnostic procedures in isolation of knowledge about clinical diagnostic and management aspects of neuromuscular diseases, may not be adequate for proper performance of an electrodiagnostic evaluation and correct interpretation of electrodiagnostic test results. Without awareness of the patterns of abnormality expected in different diseases and knowledge that the results of nerve conduction studies (NCS) and electromyography (EMG) may be similar in different diseases, diagnosis solely by EMG-NCS findings may be both inadequate and ultimately be detrimental to the patient. 4. Guidelines about proper qualifications for qualified health care professionals performing electrodiagnostic evaluations have been developed and published by AANEM (American Association of Neuromuscular and Electrodiagnostic Medicine) and other medical organizations, including the AMA, the American Academy of Neurology, the American Academy of Physical Medicine and Rehabilitation, American Neurological Association, the

	American Board of Physical Therapy Specialties (ABPTS) in Clinical Electrophysiology, and the Department of Veterans Affairs.(6)"
	Added Rationale section
	In Coding section: ▪ Added CPT codes: 95907, 95908, 95909, 95910, 95911, 95912, 95913, (effective 01-01-2013) ▪ Removed CPT codes: 95900, 95903, 95904, 95934, 95936 (effective 12-31-2012); 95921, 95922, 95923 ▪ Removed Diagnosis codes: 337.1, 337.3
	Revision section: ▪ Removed the 02-17-2006, 03-07-2006, and 12-01-2006 details.
	References updated
02-28-2014	In Coding Section: ▪ ICD-10 Diagnoses Codes added
07-29-2014	Description section reviewed.
	Policy section reviewed.
	Rationale section reviewed.
	In Coding section: ▪ Revised nomenclature for CPT codes: 95885, 95886, 95887.
	References updated.
10-01-2017	In Coding section: ▪ Added ICD-10 Codes: M48.061, M48.062 ▪ Removed ICD-10 Code: M48.06 ▪ Revised Nomenclature on ICD-10 Codes: M33.01, M33.02, M33.09, M33.11, M33.12, M33.19
10-27-2017	Corrected 10-01-2017 Revision section: ▪ Corrected codes in the Added ICD-10 Codes from "M48.61, M48.62" to "M48.061, M48.062". ▪ Added codes in the Revised Nomenclature on ICD-10 Codes, which were missing. The codes are: "M33.01, M33.02, M33.09, M33.11, M33.12, M33.19"
10-01-2018	In the Coding section: ▪ Added ICD-10 Codes: G51.31, G51.32, G51.33, G71.01, G71.02, G71.09 ▪ Remove ICD-10 Codes: G51.3, G71.0
03-01-2021	Description section updated
	In Policy section: ▪ In Item 1 Chart A add "Nerve Conduction Studies (Total Nerves Studied 95907-95913)" for each indication. ▪ In Item 1 Chart B to clarify the policy added "*CPT Appendix J lists the nerves that can be tested and coded under nerve conduction study codes. The branches of each nerve are also listed, but the unit of service is limited to the nerve and not the branches." ▪ In Item 1 Chart B removed the reference to the 2020 CPT AMA publication Appendix J and included this in the References. ▪ In Policy Guidelines revised "Utilization" to "Repeat Testing" information and added information about correct coding for counting nerve studies.
	Rationale section updated
	In Coding section: ▪ Removed CPT code: 51785 ▪ Revised CPT codes: 95860, 95861, 95863, 95864, 95870 ▪ Added ICD-10 codes: G71.20, G71.21, G71.220, G71.228, G71.29 ▪ Removed ICD-10 code: G71.2
	References updated
10-01-2021	In Coding Section: (Effective 10-01-2021) • Changed nomenclature ICD-10 for code M35.03 • Added ICD-10 code M35.05; M35.06; M35.07; M35.08; M54.50; M54.51; M54.59

	Deleted ICD-10 code M54.5
10-08-2021	Title change • Electromyography and Nerve Conduction Studies
	Description section updated
	Rationale section update
	Reference section updated

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