



# CLINICAL GUIDELINES

## Peripheral Nerve Disorders (PND) Imaging Guidelines

Version 1.0

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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## Peripheral Nerve Disorders (PND) Imaging Guidelines

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## Abbreviations for Peripheral Nerve Disorders Imaging Guidelines

<b>AIDS</b>	Acquired Immunodeficiency Syndrome
<b>ALS</b>	Amyotrophic Lateral Sclerosis
<b>CIDP</b>	Chronic Inflammatory Demyelinating Polyneuropathy
<b>CNS</b>	central nervous system
<b>CPK</b>	creatinine phosphokinase
<b>CT</b>	computed tomography
<b>EMG</b>	electromyogram
<b>LEMS</b>	Lambert-Eaton Myasthenic Syndrome
<b>MG</b>	myasthenia gravis
<b>MRI</b>	magnetic resonance imaging
<b>MRN</b>	magnetic resonance neurography
<b>MRS</b>	magnetic resonance spectroscopy
<b>NCV</b>	nerve conduction velocity
<b>PET</b>	positron emission tomography
<b>PNS</b>	peripheral nervous system
<b>PNST</b>	Peripheral Nerve Sheath Tumor
<b>POEMS</b>	Polyneuropathy, Organomegaly, Endocrinopathy, M-protein, Skin changes
<b>TOS</b>	Thoracic Outlet Syndrome

## PN-1: General Guidelines

### PN-1.0: General Guidelines

A current clinical evaluation (within 60 days) is required before advanced imaging can be considered. The clinical evaluation may include a relevant history and physical examination, including a neurological examination, appropriate laboratory studies, non-advanced imaging modalities, electromyography and nerve conduction (EMG/NCV) studies. Other meaningful contact (telephone call, electronic mail or messaging) by an established patient can substitute for a face-to-face clinical evaluation.

If imaging of peripheral nerves is indicated, ultrasound is the preferred modality for superficial peripheral nerves. MRI may be used for imaging deep nerves such as the lumbosacral plexus or nerves obscured by overlying bone such as the brachial plexus or for surgical planning. CT is limited to cases in which MRI is contraindicated.

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<b>PN-2: Focal Neuropathy</b>		
<b>Focal Disorder</b>	<b>EMG/NCV Initially?</b>	<b>Advanced Imaging</b>
Carpal Tunnel Syndrome	YES	<ul style="list-style-type: none"> <li>➤ Ultrasound Wrist or MRI Wrist without contrast (CPT® 73221) to estimate size of the carpal tunnel and diameter of the median nerve may be helpful in the evaluation and confirmation of carpal tunnel syndrome pre-operatively when EMG findings are equivocal and clinical findings are uncertain.</li> <li>➤ See <b>MS-21: Wrist</b> in the Musculoskeletal Imaging Guidelines and <b>SP-3: Neck (Cervical Spine) Pain Without/With Neurological Features (Including Stenosis) and Trauma</b> in the Spine Imaging Guidelines.</li> </ul>
Ulnar Neuropathy	YES	Ultrasound for evaluation when clinical findings and EMG/NCV findings are uncertain. MRI Elbow without contrast (CPT® 73221) or MRI Upper Arm or Forearm without contrast (CPT® 73218) for complex cases when diagnosis remains uncertain after EMG and US or for pre-op planning.
Radial Neuropathy	YES	<ul style="list-style-type: none"> <li>➤ MRI Upper Arm or Forearm without contrast (CPT® 73218) in severe cases when surgery is being considered.</li> <li>➤ MRI Upper Arm or Forearm without and with contrast (CPT® 73220) if there is a suspicion of a nerve tumor such as a neuroma.</li> </ul>
<p><b>Radial Neuropathy Notes:</b> Leads to wrist drop with common sites of entrapment the inferior aspect of the humerus (Saturday night palsy) or the forearm (Posterior Interosseus Syndrome). Trauma or fractures of the humerus, radius, or ulna can damage the radial nerve.</p>		
Sciatic Neuropathy	YES	MRI Pelvis without contrast (CPT® 72195) may be performed in the evaluation of these entities. CT Pelvis without contrast is not indicated due to lack of soft tissue contrast. It should only be performed in the rare circumstance of contrast allergy and contraindication to MRI such as pacemaking device.
<p><b>Sciatic Neuropathy Notes:</b> Trauma to the gluteal area with hematoma, injection palsy, hip or pelvic fractures, or hip replacement (arthroplasty) and rarely Piriformis Syndrome involves entrapment of the sciatic nerve at the sciatic notch in the pelvis by a tight piriformis muscle band.</p>		
Femoral Neuropathy	NO	MRI Pelvis without contrast (CPT® 72195) may be performed in the evaluation of these entities.

Focal Disorder	EMG/NCV Initially?	Advanced Imaging
<p><b>Femoral Neuropathy Notes:</b> May occur as a complication of pelvic surgery in women or those on anticoagulants with retroperitoneal bleeding, or as a mononeuropathy in diabetics</p>		
<p>Meralgia Paresthetica</p>	<p>NO</p>	<p>MRI Pelvis without contrast (CPT® 72195) may be performed in cases of diagnostic uncertainty or for pre-op planning. CT Pelvis without contrast is not indicated due to lack of soft tissue contrast. It should only be performed in the rare circumstance of contrast allergy and contraindication to MRI such as pacemaking device.</p>
<p><b>Meralgia Paresthetica Notes:</b> Sensory loss in the lateral femoral cutaneous nerve as it exits the pelvis under the inguinal ligament (lateral thigh without extension into lower leg), and is usually easily diagnosed based on a careful history and physical exam. EMG/NCV testing is often technically difficult and not required.</p>		
<p>Peroneal Neuropathy</p>	<p>YES</p>	<p>MRI Knee without contrast (CPT® 73721) or MRI Lower Extremity other than joint without contrast (CPT® 73718) in severe cases when surgery is considered.</p>
<p>Tarsal Tunnel Syndrome</p>	<p>N/A</p>	<p>See <b>MS-27: Foot (Tarsal Tunnel Syndrome)</b> in the Musculoskeletal Imaging Guidelines.</p>

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<b>PN-3: Polyneuropathy</b>			
<b>Poly-Disorder</b>	<b>EMG/NCV Initially?</b>	<b>Advanced Imaging</b>	<b>Comments</b>
<b>PNS/CNS Crossover Syndromes</b>	YES	MRI Brain and/or Spinal Cord without and with contrast if clinical findings point to abnormalities in those areas.	Examples: Guillain-Barré syndrome and Lyme disease
<b>AIDS Related Cytomegaloviral Neuropathy/ Radiculopathy</b>	YES	MRI Lumbar Spine without and with contrast (CPT® 72158) if suspected.	Urinary retention and a clinically confusing picture in the legs.
<b>Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)</b>	YES	MRI Lumbar Spine without and with contrast (CPT® 72158) if uncertain following EMG. See <b>PN-4: Brachial Plexus</b> , <b>PN-5: Lumbar and Lumbosacral Plexus</b> , and <b>PN-6.2: Muscle Diseases</b>	
<b>Multifocal Motor Neuropathy</b>	YES	MRI Brachial Plexus without and with contrast (CPT® 71552 or CPT® 73220) if uncertain following EMG.	
<b>POEMS (Polyneuropathy, Organomegaly, Endocrinopathy, M-protein, Skin changes)</b>	YES	Advanced imaging is for the non-neurological entities of this rare osteosclerotic plasmacytoma syndrome.	See <b>ONC-25: Multiple Myeloma and Plasmacytomas</b> in the Oncology Imaging Guidelines.
<b>Subacute Sensory Neuronopathy &amp; Other Paraneoplastic Demyelinating Neuropathies</b>	YES	Advanced imaging should be guided by specific clinical concern (See relevant guideline). For evaluation of suspected paraneoplastic syndromes: See <b>ONC-30.3: Paraneoplastic Syndromes</b> in the Oncology Imaging Guidelines	

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## PN-4: Brachial Plexus

- Brachial plexus studies can be coded either as MRI Upper Extremity other than joint without or without and with contrast (CPT® 73218 or CPT® 73220), MRI Chest without or without and with contrast (CPT® 71550 or CPT® 71552) or MRI Neck without or without and with contrast (CPT® 70540 or CPT® 70543) (if upper trunk) after EMG/NCV examination for:
  - ◆ Malignant infiltration (EMG not required)
  - ◆ Radiation plexitis to rule out malignant infiltration
  - ◆ Brachial plexitis (Parsonage-Turner Syndrome or painful brachial amyotrophy).
    - Self-limited syndrome characterized by initial shoulder region pain followed by weakness of specific muscles in a pattern which does not conform to involvement of a single root or distal peripheral nerve
    - Consider MRI Cervical Spine if radiculopathy.
    - See **SP-3: Neck (Cervical Spine) Pain Without/With Neurological Features (Including Stenosis) and Trauma** in the Spine Imaging Guidelines
  - ◆ Traumatic injury (MRI Cervical Spine CPT® 72141 may be approved)
  - ◆ Neurogenic Thoracic Outlet Syndrome (TOS) failed a 2 to 3 month trial of conservative management and are being considered for surgical treatment.
  - ◆ See **CH-31: Thoracic Outlet Syndrome (TOS)** in the Chest Imaging Guidelines
  - ◆ Preoperative study which requires evaluation of the brachial plexus
  - ◆ MRI Chest and Neck are inherently bilateral; whereas MRI Upper Extremity is unilateral.
  - ◆ MRI should be performed prior to consideration of PET imaging.
  - ◆ If unable to have a MRI (e.g. implanted device), CT offers the next highest level of anatomic visualization and can characterize local osseous or vascular anatomy and injury
  - ◆ For PET imaging requests, See **ONC-1.4: PET Imaging in Oncology** in the Oncology Imaging Guidelines.

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## PN-5: Lumbar and Lumbosacral Plexus

- The following studies can be considered: MRI Pelvis without and with contrast with fat suppression imaging (CPT® 72197) **OR** MRI Abdomen and Pelvis without and with contrast with fat suppression imaging (CPT® 74183 and CPT® 72197) **OR** if MRI is not available, CT Pelvis with contrast (CPT® 72193) **OR** CT Abdomen and Pelvis with contrast (CPT® 74177) can be considered after EMG/NCV based on whether the upper lumbar plexus (abdominal retroperitoneal space) or the lumbosacral plexus (pelvis), respectively, is involved based on:
  - ◆ Malignant infiltration (EMG not required)
  - ◆ Radiation plexopathy to rule out malignant infiltration
  - ◆ Traumatic injury (MRI Lumbar Spine without contrast CPT® 72148 including post-surgical cases may be approved)
  - ◆ Inflammation
  - ◆ Toxic
  - ◆ Metabolic
  - ◆ MRI should be performed prior to consideration of PET imaging.
  - ◆ If unable to have a MRI (e.g. implanted device), CT offers the next highest level of anatomic visualization and can characterize local osseous or vascular anatomy and injury.
  - ◆ For PET imaging requests, See **ONC-1.4: PET Imaging** in Oncology in the Oncology Imaging Guidelines

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**PN-6: Muscle Disorders**

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## **PN-6.1: Neuromuscular Disease**

- Myasthenia Gravis (MG) is associated with thymic disease and can undergo:
  - ◆ CT Chest with contrast (CPT® 71260) after an established diagnosis of MG.
    - Can be repeated if initial CT previously negative and now symptoms of chest mass, rising anti-striated muscle antibody titers, or need for preoperative evaluation (clinical presentation, electro-diagnostic studies, and antibody titers).
  - ◆ CT Chest without contrast (CPT® 71250) may be used if there is concern regarding adverse effects of contrast in patients with MG.
- Lambert–Eaton myasthenic syndrome (LEMS) is associated with small cell lung cancer and can undergo:
  - ◆ CT Chest with contrast (CPT® 71260) with a suspected diagnosis (Chest x-ray, symptoms of lung mass, clinical presentation, electro-diagnostic studies, and antibody titers).
    - Can be repeated if initial CT previously negative after 3 months with persistent suspicion.
- Stiff man syndrome is associated with small cell lung cancer and breast cancer
  - ◆ CT Chest with contrast (CPT® 71260) if Stiff Man Syndrome is suspected based on clinical findings.

## **PN-6.2: Muscle Diseases**

- MRI and ultrasound are increasingly being used in the evaluation of muscle disease. MRI may be helpful in demonstrating abnormalities in muscles that are difficult to examine or not clinically weak, and MRI can also help distinguish between different types of muscle disease. MRI is also useful in determining sites for muscle biopsy.
- MRI Lower Extremity other than joint without contrast (CPT® 73718) or MRI Lower Extremity other than joint without and with contrast (CPT® 73720) and/or MRI Upper Extremity other than joint without contrast (CPT® 73218) or MRI Upper Extremity other than joint without and with contrast (CPT® 73220), usually the most affected muscle is imaged (when criteria is met imaging can be approved for bilateral studies) for:
  - ◆ Additional evaluation of myopathy or myositis (based on clinical exam and adjunct testing with EMG/NCV and labs)
  - ◆ To plan muscle biopsy
  - ◆ See **PEDMS-10.3: Inflammatory Muscle Diseases** in the Pediatric Musculoskeletal Imaging Guidelines
  - ◆ See **CH-11.1: Interstitial Disease** for interstitial lung disease associated with inflammatory myopathies
- All cases with dermatomyositis and polymyositis can undergo search for occult neoplasm See **ONC-30.3: Paraneoplastic Syndromes** in the Oncology Imaging Guidelines

### **PN-6.3: Gaucher Disease (Storage Disorders)**

- See **AB-11: Gaucher Disease and Hemochromatosis** in the Abdomen Imaging Guidelines.
- See **PEDPN-4: Gaucher Disease** in the Pediatric Peripheral Nerve Disorders Imaging Guidelines.

#### ***Practice Notes***

- Myasthenia gravis is an autoimmune disease of the neuromuscular junctions, manifested by fatiguable weakness of the cranial nerves (examples - ocular: ptosis, diplopia, bulbar: dysphagia, dysarthria, dysphonia), as well as generalized limb weakness, depending on the severity of the disease. Associated antibodies: acetylcholine receptor (AChR), muscle specific kinase (MuSK).
- Lamber Eaton Myasthenic Syndrome is also an autoimmune disease affecting the neuromuscular junction presenting with ocular and bulbar symptoms and proximal limb weakness. Associated antibodies: P/Q voltage-gated calcium channel (VGCC).
- Stiff-person syndrome is an autoimmune disease associated with muscle spasm and muscle rigidity affecting the trunk and limb muscles. Associated antibodies: Glutamic acid decarboxylase (GAD)

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## PN-7: Magnetic Resonance Neurography (MRN)

- MRN is currently considered investigational by most payers.
- Use limited to evaluation of complicated cases and diagnostic uncertainty when other studies (EMG/NCV, ultrasound) are equivocal or non-diagnostic and results will determine intervention and/or surgical planning for peripheral nerve surgery and repair

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## PN-8: Amyotrophic Lateral Sclerosis (ALS)

- MRI Brain, Cervical, Thoracic, and Lumbar Spine without contrastor without and with contrast are approvable.
  - ◆ Can be considered when ALS is suspected (combination of upper and lower motor neuron findings) to establish a diagnosis.
  - ◆ Repeat imaging can be evaluated based on the appropriate **Spine Imaging Guidelines**.

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## PN-9: Peripheral Nerve Sheath Tumors (PNST)

- PNST such as (Schwannomas or Neurofibromas) arise from Schwann cells or other connective tissue of the nerve. They can be located anywhere in the body. When suspected, advanced imaging may include:
  - ◆ MRI Brain without and with contrast (CPT® 70553) for a Vestibular Schwannoma. See **HD-33.1: Acoustic Neuroma and Other Cerebellopontine Angle Tumors** in the Head Imaging Guidelines
  - ◆ MRI Cervical, Thoracic, and Lumbar Spine without and with contrast (CPT® 72156, CPT® 72157, and CPT® 72158) for suspected paraspinal neurofibroma
  - ◆ Follow-up imaging is not needed unless:
    - New symptoms or neurological findings develop
    - Post operatively, at the discretion of or in consultation with the surgeon or to reestablish baseline if the tumor was not completely removed
    - Malignant transformation (5%) is known or suspected. This may include a metastatic work-up with CT Chest and Abdomen with contrast (CPT® 71260 and CPT® 74160).
- See **PEDONC-2.3: Neurofibromatosis 1 and 2 (NF1 and NF2)** in the Pediatric Oncology Imaging Guidelines

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## PN-10: Nuclear Imaging

- Nuclear Medicine
  - ◆ Nuclear medicine studies are not generally indicated in the evaluation of peripheral nerve disorders. See **PEDPN-2: Neurofibromatosis** in the Pediatric Peripheral Nerve Disorders Imaging Guidelines for specific imaging guidelines regarding PET/CT in evaluation of peripheral nerve tumors.