



CLINICAL GUIDELINES

Pediatric Peripheral Nerve and Neuromuscular Disorders (PNND) Imaging Guidelines

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EviCore
By ~~EVERNORTH~~

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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General Guidelines (PEDPN-1)

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Procedure Codes Associated with Peripheral Nerve And Neuromuscular Disorders (PNND) Imaging

PNP.GG.ProcedureCodes.A
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MRI	CPT®
MRI Neck without contrast	70540
MRI Neck without and with contrast	70543
MRI Cervical without contrast	72141
MRI Cervical without and with contrast	72156
MRI Brachial Plexus without contrast (unilateral)	73218
MRI Brachial Plexus without and with contrast (unilateral)	73220
MRI Brachial Plexus without contrast (bilateral)	71550
MRI Brachial Plexus without and with contrast (bilateral)	71552
MRI Chest without contrast	71550
MRI Chest without and with contrast	71552
MRI Thoracic without contrast	72146
MRI Thoracic without and with contrast	72157
MRI Lumbar without contrast	72148
MRI Lumbar without and with contrast	72158
MRI Abdomen without contrast	74181

MRI	CPT [®]
MRI Abdomen without and with contrast	74183
MRI Pelvis without contrast	72195
MRI Pelvis without and with contrast	72197
MRI Upper Extremity Other Than Joint without contrast	73218
MRI Upper Extremity Other Than Joint with contrast	73219
MRI Upper Extremity Other Than Joint without and with contrast	73220
MRI Upper Extremity Joint without contrast	73221
MRI Upper Extremity Joint with contrast	73222
MRI Upper Extremity Joint without and with contrast	73223
MRI Lower Extremity Other Than Joint without contrast	73718
MRI Lower Extremity Other Than Joint with contrast	73719
MRI Lower Extremity Other Than Joint without and with contrast	73720
MRI Lower Extremity Joint without contrast	73721
MRI Lower Extremity Joint with contrast	73722
MRI Lower Extremity Joint without and with contrast	73723
Unlisted MRI procedure (for radiation planning or surgical software)	76498

MRA	CPT [®]
MRA Upper Extremity	73225
MRA Lower Extremity	73725

Nuclear Medicine	
PET Imaging; limited area (this code not used in pediatrics)	78811
PET Imaging; skull base to mid-thigh (this code not used in pediatrics)	78812
PET Imaging; whole body (this code not used in pediatrics)	78813
PET with concurrently acquired CT; limited area (this code rarely used in pediatrics)	78814
PET with concurrently acquired CT; skull base to mid-thigh	78815
PET with concurrently acquired CT; whole body	78816
Bone Marrow Imaging Limited Areas	78102
Bone Marrow Imaging Multiple Areas	78103
Bone Marrow Imaging Whole Body	78104
Nuclear Bone Scan Limited	78300
Nuclear Bone Scan Multiple Areas	78305
Nuclear Bone Scan Whole Body	78306
Bone Scan Three Phase	78315
Radiopharmaceutical Localization Imaging Limited Area	78800
Radiopharmaceutical Localization Imaging Whole Body	78802
Radiopharmaceutical Localization Imaging SPECT	78803

General Guidelines (PEDPN-1.0)

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- A pertinent clinical evaluation including a detailed history, physical examination since the onset or change in symptoms with a thorough neurologic examination, appropriate laboratory studies, and basic imaging such as plain radiography or ultrasound should be performed prior to considering advanced imaging (CT, MRI, Nuclear Medicine), unless the individual is undergoing guideline-supported scheduled imaging evaluation. A meaningful technological contact (telehealth visit, telephone call, electronic mail or messaging) since the onset or change in symptoms can serve as a pertinent clinical evaluation.
 - EMG may not be of clinical utility or obtainable in infants or individuals with severe developmental delay
 - EMG/NCS results may not be abnormal until 10 days after injury.
- Unless otherwise stated in a specific guideline section, the use of advanced imaging to screen asymptomatic individuals for disorders involving the peripheral nervous system is not supported. Advanced imaging of the peripheral nervous system is only appropriate in individuals who have documented active clinical signs or symptoms of disease involving the peripheral nervous system.
- Unless otherwise stated in a specific guideline section, repeat imaging studies of the peripheral nervous system are not necessary unless there is evidence for progression of disease, new onset of disease, and/or documentation of how repeat imaging will affect individual management or treatment decisions.

Health Equity Considerations

Health equity is the highest level of health for all individuals; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which individuals are born, grow, live, work, and age. Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include the following: safe housing, transportation, and neighborhoods; racism, discrimination, and violence; education, job opportunities, and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

Age Considerations (PEDPN-1.1)

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- Many conditions affecting the peripheral nervous system in the pediatric population are different diagnoses than those occurring in the adult population. For those diseases that occur in both pediatric and adult populations, minor differences may exist in management due to individual age, comorbidities, and differences in disease natural history between children and adults.
- Individuals who are 18 years old or younger should be imaged according to the Pediatric Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines if discussed. Any conditions not specifically discussed in the Pediatric Peripheral Nerve and Neuromuscular Disorder Imaging Guidelines should be imaged according to the General Peripheral Nerve Disorder Imaging Guidelines. Individuals who are >18 years old should be imaged according to the General Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines, except where directed otherwise by a specific guideline section.

Modality General Considerations (PEDPN-1.3)

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- MRI
 - MRI without and with contrast is the preferred modality for pediatric peripheral nerve imaging unless otherwise stated in a specific guideline section.
 - Due to the length of time required for MRI acquisition and the need to minimize individual movement, anesthesia is usually required for almost all infants (except neonates) and young children (age <7 years) as well as older children with delays in development or maturity. This anesthesia may be administered via oral or intravenous routes. In this individual population, MRI sessions should be planned with a goal of minimizing anesthesia exposure by adhering to the following considerations:
 - MRI procedures can be performed without and/or with contrast as supported by these condition-based guidelines. If intravenous access will already be present for anesthesia administration and there is no contraindication for using contrast, imaging without and with contrast may be appropriate if requested. By doing so, the requesting provider may avoid repetitive anesthesia administration to perform an MRI with contrast if the initial study without contrast is inconclusive.
 - Recent evidence based literature demonstrates the potential for gadolinium deposition in various organs including the brain after the use of MRI contrast.
 - The U.S. Food and Drug Administration (FDA) has noted that there is currently no evidence to suggest that gadolinium retention in the brain is harmful and restricting gadolinium-based contrast agents (GBCAs) use is not warranted at this time. It has been recommended that GBCA use should be limited to circumstances in which additional information provided by the contrast agent is necessary and the necessity of repetitive MRIs with GBCAs should be assessed.
 - If multiple body areas are supported by the guidelines for the clinical condition being evaluated, MRI of all necessary body areas should be obtained concurrently in the same anesthesia session.
- CT
 - CT is rarely used in the evaluation of pediatric peripheral nerve disorders. See specific guideline sections for indications.
- Ultrasound
 - Ultrasound is rarely used in the evaluation of pediatric peripheral nerve disorders. See specific guideline sections for indications.

- Nuclear Medicine
 - Nuclear medicine studies are generally not medically necessary in the evaluation of peripheral nerve disorders. See for specific imaging guidelines regarding PET/CT in evaluation of peripheral nerve tumors.
- 3D Rendering
 - 3D Rendering indications in pediatric PND imaging are identical to those in the general imaging guidelines. See **3D Rendering (Preface-4.1)** in the Preface Imaging Guidelines.
- The guidelines listed in this section for certain specific indications are not intended to be all-inclusive; clinical judgment remains paramount and variance from these guidelines may be appropriate and warranted for specific clinical situations

References (PEDPN-1)

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1. Bowen BC. Magnetic resonance imaging of the peripheral nervous system. In: Latchaw RE, Kucharczyk J, Moseley ME, et al., eds. *Imaging of the Nervous System*. Philadelphia, PA. Elsevier. 2005:1479-1497.
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6. Kang PB, McMillan HJ, Kuntz NL, et al. Utility and practice of electrodiagnostic testing in the pediatric population: An AANEM consensus statement. *Muscle Nerve*. 2020;61(2):143-155. doi: 10.1002/mus.26752.
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9. History and Physicals - Understanding the Requirements at <https://www.jointcommission.org/standards/standard-faqs/critical-access-hospital/medical-staff-ms/000002272/?p=1>
10. Cheeney SHE, Maloney E, Iyer RS. Safety considerations related to intravenous contrast agents in pediatric imaging. *Pediatr Radiol*. 2023;53(7):1352-1363. doi:10.1007/s00247-022-05470-z
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Neurofibromatosis (PEDPN-2)

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Neurofibromatosis – General Information (PEDPN-2.0)

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- This guideline section includes imaging indications for individuals with neurofibromatosis and known benign lesions.
- For cancer screening guidelines, see **Neurofibromatosis 1 and 2 (NF1 and NF2) (PEDONC-2.3)** in the Pediatric Oncology Imaging Guidelines.
- For Peripheral Nerve Sheath Tumors, see **Peripheral Nerve Sheath Tumors (PNST) (PND-9.1)** in the Peripheral Nerve and Neuromuscular Disorders (PND) Imaging Guidelines.
- For guidelines related to known malignancies in individuals with NF1, see the appropriate imaging guideline for the specific cancer type.

Neurofibromatosis 1 (PEDPN-2.1)

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- See **Neurofibromatosis 1 and 2 (NF1 and NF2) (PEDONC-2.3)** in the Pediatric Oncology Imaging Guidelines.
- For Peripheral Nerve Sheath Tumors, see **Peripheral Nerve Sheath Tumors (PNST) (PND-9.1)** in the Peripheral Nerve Disorders and Neuromuscular (PND) Imaging Guidelines.
- For guidelines related to known malignancies in individuals with NF1, see the appropriate imaging guideline for the specific cancer type.

Neurofibromatosis 2 (PEDPN-2.2)

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- See **Neurofibromatosis 1 and 2 (NF1 and NF2) (PEDONC-2.3)** in the Pediatric Oncology Imaging Guidelines.
- Individuals with NF2 and known meningioma should be imaged according to guidelines in **Meningiomas (Intracranial and Intraspinal) (ONC-2.8)** in the Oncology Imaging Guidelines.
- Individuals with NF2 and known ependymoma should be imaged according to guidelines in **Ependymoma (PEDONC-4.8)** in the Pediatric Oncology Imaging Guidelines.

Brachial Plexus (PEDPN-3)

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Brachial Plexus (PEDPN-3.1)

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Disorders of the brachial plexus can generally be identified and distinguished from lesions in other locations by clinical and electromyography/nerve conduction (EMG/NCV) examination. If the diagnosis remains unclear, advanced imaging can be helpful as a pre-operative study to evaluate the anatomy of brachial plexus lesions that should have already been defined by clinical examination. However, due to the technical challenges, EMG/NCV is not required prior to imaging in children.

- MRI is the preferred modality for imaging the brachial plexus.
 - CT is not often useful and should not be used as a substitute for MRI.
 - MRI Upper Extremity Other Than Joint without contrast (CPT[®] 73218) or MRI Upper Extremity Other Than Joint without and with contrast (CPT[®] 73220) is medically necessary for unilateral brachial plexus.
 - MRI Chest without contrast (CPT[®] 71550) or MRI Chest without and with contrast (CPT[®] 71552) is medically necessary for bilateral brachial plexus studies.
 - MRI Neck without contrast (CPT[®] 70540) is indicated for upper trunk lesions.
 - It is rare for more than one CPT[®] code to be necessary to adequately image the brachial plexus area of interest.
 - MRI Shoulder without contrast (CPT[®] 73221) or MRI Shoulder without and with contrast (CPT[®] 73223) is medically necessary in infants with brachial plexopathy due to birth trauma if requested for preoperative planning. These individuals often have glenohumeral dysplasia and require shoulder surgery.
 - MRI Cervical Spine without contrast (CPT[®] 72141) is medically necessary if there is clinical suspicion for cervical nerve root avulsion.
 - PET/CT skull base to mid-thigh (CPT[®] 78815) is appropriate if there is a contraindication to MRI in individuals with a known malignancy or post-treatment syndrome.

Background and Supporting Information

The goal of imaging is to visualize the entire course of the neural network from the preganglionic to the postganglionic segments

The MRI Chest and Neck are inherently bilateral, whereas MRI Upper Extremity is unilateral.

References (PEDPN-3)

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Gaucher Disease

(PEDPN-4)

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Gaucher Disease (PEDPN-4.1)

PNP.GD.0004.1.A

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- Gaucher Disease imaging indications in pediatric individuals are very similar to those for adult individuals. See **Gaucher Disease (Storage Disorders) (PN-6.3)** in the Peripheral Nerve and Neuromuscular Disorders(PND) Imaging Guidelines.

Spinal Muscular Atrophy (PEDPN -5)

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Spinal Muscular Atrophy (PEDPN-5.1)

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- Spinal Muscular Atrophy
 - Molecular genetic testing is the standard tool for diagnosis for the early consideration in any infant with weakness or hypotonia
 - MRI is usually not medically necessary
 - See **Developmental Motor Delay (PEDHD-19.3)** in the Pediatric Head Imaging Guidelines for presentation of weakness or a loss of skills.

References (PEDPN-5)

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1. Nance JR. Spinal Muscular Atrophy. *Continuum (Minneap Minn)*. 2020;26(5, Peripheral Nerve And Motor Neuron Disorders):1348–1368.
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