AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **THORACIC SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72146, 72147, 72157, +0698T	**Last Revised Date: ~~April~~ March 2022~~1~~**
Guideline Number: NIA_CG_042	**Implementation Date: January 2023~~2~~**

INDICATIONS FOR THORACIC SPINE MRI

+If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow--up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient (the entire spinal cord and/or autonomic postganglionic chain must be assessed)~~t.~~**

(*Unless approvable in the combination section as noted in the guidelines)

~~**(Combination requests at end of the document)**~~

For evaluation of neurologic deficits[1-4]

~~(Acharya, 2019; ACR, 2013; NASS, 2010; Stolper, 2017)~~

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness **(and not likely caused by plexopathy~~,~~ or peripheral neuropathy)**[5, 6]
  - Pathologic (e.g., Babinski~~, Lhermitte's sign~~, Chaddock Sign) or abnormal reflexes[7] ~~(Teoli, 2021)~~
  - Absent/decreased sensory changes along a particular thoracic dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature~~, or a defined thoracic spinal cord level or part of a myelopathy~~
  - Upper or lower extremity increase muscle tone/spasticity**, and likely localized to the thoracic spinal cord** ~~or a multi-focal central nervous system process, (e.g. Multiple Sclerosis, Other Demyelinating Diseases, and Auto-Immune/Inflammatory Diseases)~~
  - New onset bowel or bladder dysfunction (e.g., retention or incontinence**)- not related to an inherent bowel or bladder process**
  - Gait abnormalities**, most likely cause by a suspected or known myelopathy** (see **Table 1** for more details)

* National Imaging Associates, Inc. (NIA) is a subsidiary of Magellan Healthcare, Inc.

- Suspected thoracic cord compression with any neurological deficits as listed above.
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For evaluation of back pain with any of the following[8-10]
~~(Allegri, 2016; AANSCNS, 2014; Jarvik, 2015)~~

- With new or worsening objective **neurologic deficits** (as listed above) on exam
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a thoracic radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain ~~(NASS, 2013)~~)[11]
- Isolated thoracic back pain in pediatric population[12] ~~(ACR, 2016)~~ – conservative care not required if red flags present ~~(see~~
    - Red flags that prompt imaging should include the presence of: age 5 or younger, constant pain, pain lasting >4 weeks, abnormal neurologic examination, early morning stiffness and/or gelling; night pain that prevents or disrupts sleep; radicular pain; fever; weight loss; malaise; postural changes (e.g., kyphosis or scoliosis); and limp (or refusal to walk in a younger child <5yo) AND initial radiographs have been performed[13, 14] ~~(Bernstein, 2007; Feldman, 2006)~~

  ~~Back pain associated with suspected inflammation, infection, or malignancy~~

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion"[15, 16] ~~(ACR, 2015; Rao, 2018)~~ and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- Prior to spinal cord stimulator to exclude canal stenosis if no prior MRI imaging of the thoracic spine has been done recently[17, 1817] ~~(Carayannopoulos, 2019)~~
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula~~)~~ **or dural fistula)**)
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- ~~Changing neurologic status post-operatively~~
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- **New or changing neurological deficits or symptoms post-operatively** ~~Residual or new neurological deficits or symptoms[11] (Rao, 2018)- see Residual or new neurological deficits or symptoms[15, 19] (Rao, 2018)~~ - see **neurological deficit** section above
- **When combo requests (see above statement[+]) are submitted** ~~When combo requests~~ (i.e., MRI and CT of the spine), the office notes should clearly document the need for both

studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[20] ~~(Fisher, 2013)~~

- Combination requests where both thoracic spine CT and MRI thoracic spine are both approvable (not an all-inclusive list):
  - OPLL (Ossification of posterior longitudinal ligament)-
    - Most common in cervical spine (rare but more severe in thoracic spine)[21] ~~(Choi, 2011)~~
  - Pathologic or complex fractures
  - Malignant process of spine with both bony and soft tissue involvement
  - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy[22-26]
~~(ACR, 2015; Behrbalk, 2013; Davies, 2018; Sarbu, 2019; Vilaca, 2016)~~

- Does **NOT** require conservative care
- **Progressive symptoms including unsteadiness, broad-based gait, increased muscle tone, pins and needles sensation, weakness and wasting of the lower limbs, and diminished sensation to light touch, temperature, proprioception, and vibration; limb hyperreflexia and pathologic reflexes; bowel and bladder dysfunction in more severe cases.** ~~Progressive symptoms including hand clumsiness, worsening handwriting, difficulty with grasping and holding objects, diffuse numbness in the hands, pins and needles sensation (i.e. paresthesia), increasing difficulty with balance and ambulation~~
-
- Any of the **neurological deficits** as noted above

For evaluation of known or suspected multiple sclerosis (MS)[26-29]
~~(ACR, 2015; CMSC, 2018; Filippi, 2016; Kaunzner, 2017)~~

- Suspected or known MS with new or changing symptoms suggesting underlying thoracic spinal cord disease (i.e., transverse myelitis, progressive myelopathy)
- Suspected or known pediatric demyelinating diseases (MS/ADEM)

Combination studies for MS

- **These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.**
  - **Cervical and/or Thoracic MRI for evaluation of highly suspected multiple sclerosis (MS) when Brain MRI has indeterminate findings and/or does not fulfill the McDonald criteria for the diagnosis of MS** ~~does not fulfill diagnostic criteria~~[28]
  - ~~Cervical **and/or** Thoracic MRI for evaluation of suspected multiple sclerosis (MS) when Brain MRI does not fulfill diagnostic criteria[22] (Filippi, 2016)~~

- Cervical **and/or** Thoracic MRI with suspected transverse myelitis-with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days)
- Brain MRI with Cervical **and/or** Thoracic MRI for evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[30] ~~(Wingerchuk, 2015)~~
- Known MS~~,~~ entire CNS axis (Brain, **and/or** Cervical **and/or** Thoracic spine) is approvable prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)
- Known MS Follow-up scans, including brain and spine imaging, if patients have known spine disease:
  - 6-12 months after starting/changing treatment
  - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years

For evaluation of trauma or acute injury ~~(ACR, 2018)~~[31]

- Presents with any of the following **neurological deficits** as above
- With progression or worsening of symptoms during the course of a trial of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) **(Both MRI and CT would be approvable)**[32-34] ~~(ACR, 2021; Koivikko, 2008; Taljanovic, 2009)~~
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations") ~~(ACR, 2018)~~.[31]

For evaluation of known or new compression fractures with worsening back pain[31, 35] ~~(ACR, 2018)~~

- With history of malignancy
  - To aid in differentiation of benign osteoporotic fractures from metastatic disease
    - A follow-up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher (indeterminate) benign osteoporotic fracture from metastatic disease[36] ~~(Kumar, 2016)~~
- With an associated new focal **neurologic deficit** as above
- Prior to a planned surgery/intervention or if the results of the MRI will change management

For evaluation of tumor, cancer, or metastasis with any of the following:~~;~~
(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[37-39] ~~(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)~~[31 33] ~~33~~
~~(Kim, 2012; McDonald, 2019; Roberts, 2010)~~

- **Primary tumor**
  - Initial staging or re-staging of a known primary spinal tumor[40] ~~(NCCN 2021)~~
  - Known primary tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
  - With an associated new focal **neurologic deficit** as above[41] ~~(Alexandru, 2012)~~

- **Metastatic tumor**
  - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
- ~~Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine~~
  - With an associated new focal neurologic deficit[41] ~~(Alexandru, 2012)~~
  - **Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or ~~neck~~back pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine** [33-35]
- ~~Initial imaging of new or increasing non-traumatic back pain or radiculopathy or back pain occurs at night and wakes the patient from sleep with known active cancer and a tumor that tends to metastasize to the spine[33, 35] (McDonald,2019; Ziu, 2019)~~

- **For evaluation of inconclusive finding on prior imaging that requires further clarification**
  - One follow-up exam to ensure no suspicious change has occurred in prior imaging finding. No further surveillance unless specified as highly suspicious or change was found on last follow-up exam[39] ~~(ACR, 2018)~~

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection, abscess, or inflammatory disease[42, 43] ~~(ACR, 2015; Lerner, 2018)~~

- **Infection**
  - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[44] ~~(Bond, 2016)~~
  - Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[45] ~~(Berbari, 2015)~~
    -
- **Spondyloarthropathies**

- Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[43]
~~(ACR, 2015)~~

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Thoracic Spine MRI
(Note- See **combination requests**, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[46-48] ~~(AANS, 2019; Duz, 2008; Milhorat, 2009)~~
- Known Arnold-Chiari syndrome (For **initial imaging** **(one-time initial MRI-modality assessment)** see combination below)
  - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[49] ~~(Hitson, 2015)~~
  - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Syrinx or syringomyelia (known or suspected)
  - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[50] ~~(Timpone, 2015)~~)
  - To further characterize a suspicious abnormality seen on prior imaging
  - Known syrinx with new/worsening symptoms
- Toe walking in a child ~~when associated~~ with ~~upper motor neuron signs, including hyperreflexia, spasticity; or orthopedic deformity with concern for spinal cord pathology (e.g., pes cavus, clawed toes, leg or foot length deformity (excluding tight heel cords))~~**signs/symptoms of myelopathy localized to the Thoracic Spine**
- **Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)**
  - **After detailed neurological exam and basic testing completed**
  - ~~o~~

COMBINATION STUDIES WITH THORACIC SPINE MRI
Cervical and Thoracic MRI

- **Initial evaluation of known syrinx or syringomyelia**
  - **With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[50])**
  - **To further characterize a suspicious abnormality seen on prior imaging**
  - **Known syrinx with new/worsening symptom**

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs

Note: ~~(~~These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[51, 52]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure ~~)~~
~~e.g.,, or in specific combination sectionsIndications for combination studies[45, 46]: (ACR, 2017, 2019) - For approved indications as noted below and being performed in a child under 8 years of age who will need anesthesia for the procedure~~

~~Any combination of Cervical and/or Thoracic and/or Lumbar MRIs~~

- Any combination of these studies for:
    - Survey/complete initial assessment of ~~Scoliosis survey in~~ infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[53-55] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)~~(ACR, 2018; SRS, 2019; Strahle, 2015)~~
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[56] ~~(Trenga, 2016)~~
    - Back pain ~~and~~ with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[57] ~~(Ozturk, 2010)~~:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30' kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations~~I~~[58, 59] ~~(Radic, 2018; Strahle, 2011)~~
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[47, 53] ~~(Milhorat, 2009; Strahle, 2015)~~
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele~~For initial evaluation and follow-up as appropriate~~
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[46-48] ~~40-42~~ when anesthesia required for imaging[60]~~54~~ (e.g., meningomyelocele, lipomeningomyelocele,

diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)~~Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[40-42] (AANS, 2019; Duz, 2008; Milhorat, 2009), when anesthesia required for imaging[54] (Hertzler, 2010)~~

- Oncological Applications (e.g., primary nervous system, metastatic)~~Toe walking in a child when associated with upper motor neuron signs including hyperreflexia, spasticity; or orthopedic deformity with concern for spinal cord pathology (e.g., pes cavus, clawed toes, leg or foot length deformity (excluding tight heel cords))~~
-
  - ~~Back pain in a child with any of the following red flags (conservative care not required when red flags present):~~
    - ~~Red flags that prompt imaging should include the presence of: age 5 or younger, constant pain, pain lasting >4 weeks, abnormal neurologic examination, early morning stiffness and/or gelling; night pain that prevents or disrupts sleep; radicular pain; fever; weight loss; malaise; postural changes (e.g., kyphosis or scoliosis); and limp (or refusal to walk in a younger child <5yo), AND initial radiographs have been performed[9, 10] (Bernstein, 2007; Feldman, 2006)~~
  - ~~-~~Drop metastasis from brain or spine (imaging also includes brain)~~- see background section~~**Overview**
  - Suspected leptomeningeal carcinomatosis (LC)[61] ~~(Shah, 2011)Suspected leptomeningeal carcinomatosis (LC)[61]~~ - see background**Overview**~~(Shah, 2011)~~
  - Any combination of these for spinal survey in patient with metastases
  - Tumor evaluation and monitoring in neurocutaneous syndromes ~~- See Background~~
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) produces high quality multiplanar images of organs and structures within the body without using ionizing radiation. It is used for evaluation, assessment of severity, and follow-up of diseases of the spine and is the preferred modality for imaging intervertebral disc degeneration. High contrast resolution (soft tissue contrast) and multiplanar imaging (sagittal as well as axial planes) are helpful in the evaluation of possible disc herniation and detecting nerve root compression. MRI is one of the most useful techniques to evaluate spine infection and is also used to evaluate tumors, cancer, and immune system suppression.

OVERVIEW

Ankylosing Spondylitis/Spondyloarthropathies is a cause of back or sacroiliac pain of insidious onset (usually > 3 month), associated with morning stiffness not relieved with rest (usually age

at onset < 40). It is associated with any of the following[62-65] ~~(Akgul, 2011; Bennett, 2010; Ostergaard, 2012; Sieper, 2014)~~:

- Sedimentation rate and/or C-reactive protein (not an essential criteria)
- HLA B27 (not an essential criteria)
- Non-diagnostic or indeterminate x-ray
- Personal or family history of sacroiliitis, peripheral inflammatory arthritis, and/or inflammatory bowel disease

***Conservative Therapy~~:~~ –** (Spine) should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or osteopathic manipulative medicine (OMT) or chiropractic care when considered safe and appropriate.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[16, 66] ~~(ACR, 2015; Last, 2009)~~:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Infection, Abscess, or Inflammatory disease

- Most common site is the lumbar spine (58%), followed by the thoracic spine (30%) and the cervical spine (11%)[67] ~~(Graeber, 2019)~~
- High risk populations (indwelling hardware, history of endocarditis, IVDA, recent procedures) with appropriate signs/symptoms

Table 1: Gait and spine imaging[68-73‡]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**

Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • ~~**Pelvis MR if there is evidence of plexopathy~~~~EMGà foot drop Lumbar spine MRI~~** • ~~Pelvis MR appropriate evidence of plexopathy~~
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI as per GL**

~~(~~[‡]~~References: Chhetri, 2014; Clinch, 2021; Gait, 2021; Haynes, 2018; Marshall, 2012; Pirker, 2017)~~

Table 2: MRI and Cutaneous Stigmata[74] ~~(Dias, 2015)~~

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Artretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Myelopathy~~:~~ – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%) ~~(Vitzthum, 2007)~~.[75]

Ossification Posterior Longitudinal Ligament (OPLL)[21] ~~(Choi, 2011)~~ – ~~-~~ Most common in cervical spine (rare but more severe in thoracic spine)

Tethered spinal cord syndrome – ~~-~~ a neurological disorder caused by tissue attachments that limit the movement of the spinal cord within the spinal column. Although this condition is rare, it can continue undiagnosed into adulthood. The primary cause is myelomeningocele and lipomyelomeningocele; the following are other associations that vary in severity of symptoms and treatment.

- Dermal sinus tract (a rare congenital deformity)
- Diastematomyelia (split spinal cord)
- Lipoma
- Tumor
- Thickened/tight filum terminale
- History of spine trauma/surgery
- Arnold-Chiari Malformation

Magnetic resonance imaging (MRI) can display the low level of the spinal cord and a thickened filum terminale, the thread-like extension of the spinal cord in the lower back. Treatment depends upon the underlying cause of the tethering. If the only abnormality is a thickened, shortened filum, then limited surgical treatment may suffice.

MRI and Spinal Infections – Infection of the spine is not easy to differentiate from other spinal disorders, e.g., degenerative disease, spinal neoplasms, and noninfectious inflammatory lesions. Infections may affect different parts of the spine, e.g., vertebrae, intervertebral discs and paraspinal tissues**, or the spinal cord tissue and/or roots themselves**. Imaging is important in obtaining an early diagnosis and treatment to avoid permanent neurologic deficits. MRI is the preferred imaging technique to evaluate infections of the spine. With its high contrast resolution and direct multiplanar imaging, ~~it has the ability to~~**MRI can** detect and delineate infective lesions irrespective of their spinal location.

Back Pain with Cancer History – ~~-~~ Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of **conservative care.**

"Neoplasms causing VCF (vertebral compression fractures) include: primary bone neoplasms, such as hemangioma or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); infiltrative neoplasms, including and not limited to, multiple myeloma and lymphoma, and metastatic neoplasms~~ (ACR, 2018)~~."[35]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process~~ (Ziu, 2019)~~.[76]

Cauda Equina Syndrome – ~~-~~ Symptoms include severe back pain or sciatica along with one or more of the following:

- Saddle anesthesia - loss of sensation restricted to the area of the buttocks, perineum, and inner surfaces of the thighs (areas that would sit on a saddle)
- Recent bladder/bowel dysfunction ~~(as listed above)~~
- Achilles reflex absent on both sides
- Sexual dysfunction that can come on suddenly
- Absent anal reflex and bulbocavernosus reflex

Spinal MRI and Neuromyelitis optica spectrum disorders (NMOSD) – ~~-~~ NMOSD are inflammatory disorders of the central nervous system characterized by severe, immune-

mediated demyelination and axonal damage predominantly affecting the optic nerves and spinal cord, but NMOSD may also affect the brain and brainstem. NMOSD can ~~be~~ **typically be** distinguished from multiple sclerosis and other inflammatory disorders by the presence of the aquaporin-4 (AQP4) antibody**; although, up to 10% of patients with NMOSD can be seronegative.**[77, 78] ~~.~~ Features of NMOSD include attacks of bilateral or sequential optic neuritis acute transverse myelitis and the area postrema syndrome (with intractable hiccups or nausea and vomiting). The evaluation of suspected NMOSD entails brain and spinal cord neuroimaging. In contrast to MS (in which spinal cord involvement tends to be incomplete and asymmetric), NMOSD have a longer extent of spinal cord demyelination generally involving three or more vertebral segments.

MRI and Neurocutaneous Syndromes

- **In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial tumors.**[79]
- **Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.**[80]
- **In patients with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.**[81]
- **In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.**[82]
- **In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only age 1 and is recommended in patients <1 year old only if symptomatic.**[83]

Drop Metastases[84]

Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[85]

Leptomeningeal carcinomatosis is complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, and melanoma, gastrointestinal, and primary central nervous system tumors.

POLICY HISTORY

Date	Summary
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Clarified combination MS for cervical and/or thoracic spine combination requests ~~Added subsection for cervical and thoracic spine section for syrinx and syringomyelia~~ • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for thoracic spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section Removed pediatric back pain from the total spine combination section •
November 2021	• Added +0698T
April 2021	• Added/modified ○ Modified section on neurological deficits ○ Back pain in a child added/modified red flags ○ Gait table in background ○ Post-surgical modified/clarified surgical criteria for combination exams ○ Removed myelopathy combination studies ○ Updated/added MS Criteria ▪ Combination section for initial imaging and follow up ▪ Added pediatric MS ○ Modified known tumor imaging into primary and metastatic disease ○ Added toe walking for pediatric patients ○ Modified Combination exam wording
May 2020	• Added ○ For evaluation of neurologic deficits when new deficits are present

	○ Removed pars defect section ○ Added ankylosing spondylitis for evaluation of trauma/acute injury ○ Added follow up of osteoporotic fracture from metastatic disease ○ Added transverse myelitis ○ Modified Initial imaging of new or increasing non-traumatic back pain or radiculopathy or back pain that occurs at night and wakes the patient from sleep with known active cancer and a tumor that tends to metastasize to the spine ○ Added Imaging of Ossification of the Posterior Longitudinal Ligament (OPPL) ○ Added Osteopathic Manipulative medicine to conservative care therapy
June 2019	• Added: ○ new or worsening objective neuro deficits for chronic and acute back pain ○ CSF leak ○ last 6 months for allowable post op f/u period and removed EMG comment ○ red flags specifically for peds back pain and pain related to malignancy, infection, inflammation ○ new sections: pars defect; compression fractures; congenital abnormalities including section on scoliosis and vertebral anomalies in children w/back pain; ○ For combination studies cervical/thoracic/lumbar added drop metastasis, tumor evaluation for neurocutaneous syndromes, and abnormalities associated w/Arnold Chiari, as well as separate indication for tethered cord or spinal dysraphism ○ Myelopathy ○ Pre op for spinal cord stimulator ○ Evaluation of MS including NMO disorders and recurrent transverse myelitis ○ Back pain in cancer patients with known active cancer in tumors that tend to metastasize ○ Expanded on tethered cord in Other Indications for Imaging and added content on sacral dimple

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~~Reviewed / Approved by NIA Clinical Guideline Committee~~

~~GENERAL INFORMATION~~

~~It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.~~

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ADDITIONAL RESOURCES

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3. Goh C, Phal PM, Desmond PM. Neuroimaging in acute transverse myelitis. *Neuroimaging Clin N Am.* Nov 2011;21(4):951-73, x. doi:10.1016/j.nic.2011.07.010

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7. Papanastassiou ID, Gerochristou M, Aghayev K, Vrionis FD. Defining the indications, types and biomaterials of corpectomy cages in the thoracolumbar spine. *Expert Rev Med Devices*. Mar 2013;10(2):269-79. doi:10.1586/erd.12.79

Reviewed / Approved by NIA Clinical Guideline Committee

GENERAL INFORMATION

It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.