AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guideline CERVICAL SPINE CT	Original Date: September 1997
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INDICATIONS FOR CERVICAL SPINE CT

[+]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.

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

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

For evaluation of neurologic deficits when Cervical Spine MRI is contraindicated or inappropriate[1-4]

~~(Acharya, 2019; ACR, 2013; NASS, 2010; Teoli, 2021)~~

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy~~,~~ or peripheral neuropathy)
  - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's) or abnormal reflexes
  - Absent/decreased sensory changes along a particular cervical dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature
  - Upper or lower extremity increase muscle tone/spasticity
  - New onset bowel or bladder dysfunction (e.g., retention or incontinence~~)—n)—n~~ot related to an inherent bowel or bladder process

~~- With any of the following new neurological deficits documented on physical exam~~
  ~~- Extremity muscular weakness~~
  ~~- Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's) or abnormal reflexes~~
  ~~- Absent/decreased sensory changes along a particular cervical dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature~~

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- ~~Upper or lower extremity increase muscle tone/spasticity~~
- ~~New onset bowel or bladder dysfunction (e.g., retention or incontinence)~~
- Gait abnormalities (see **Table 1** below for more details)

- Suspected cord compression with any neurological deficits as listed above~~.~~

For evaluation of neck pain with any of the following when Cervical Spine MRI is contraindicated[5]
~~(Allegri, 2016)~~

- With new or worsening objective **neurologic deficits** on exam, as above
- Failure of **conservative treatment*** for at least six (6) weeks within the last six (6) months[6] ~~(ACR, 2013; Eubanks, 2010)~~
- 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 cervical radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain ~~(NASS, 2013)~~)[7]
- Isolated neck pain in pediatric population[8] ~~(ACR, 2016)~~ – conservative care not required if red flags present ~~(see combination request below thoracic and lumbar spine may also be indicated)~~
  - **Red flags that prompt imaging should include the presence of the following: 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; fever; weight loss** ~~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)~~
  - ~~Neck 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"[11, 12] ~~(ACR, 2015; Rao, 2018)~~ **and MRI for cord, nerve root compression, disc pathology, or post-op infection)**

Note: If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning, a contraindication to MRI is not required.

- For preoperative evaluation/planning
- CT discogram
- 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 -preferred exam CT myelogram)[13] ~~(Starling, 2013)~~
- 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**[11, 14, 14~~10~~14] ~~Residual or new neurological deficits or symptoms~~[~~10~~] ~~(Rao, 2018)~~ - see **neurological deficit** section above.
- When combo requests **(see above statement[+])** are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously (e.g., the need for both soft tissue and bony anatomy is required)[15] ~~(Fisher, 2013)~~
    - ~~-~~Combination requests where both cervical spine CT and MRI cervical spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)[16] ~~(Choi, 2011)~~
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Unstable craniocervical junction
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy when Cervical Spine MRI is contraindicated[17-21]
~~(ACR, 2015; Behrbalk, 2013; Davies, 2018; Vilaca, 2016; Waly, 2017)~~

- Does **NOT** require conservative care
- Progressive symptoms including hand clumsiness, worsening handwriting, difficulty with grasping and holding objects, diffuse numbness in the hands, pins and needles sensation, increasing difficulty with balance and ambulation
- Any of the **neurological deficits** as noted above

For evaluation of trauma or acute injury[22]
~~(ACR, 2018)~~

- Presents with any of the following **neurological deficits** as above
- With progression or worsening of symptoms during the course of **conservative treatment***
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis) **(~~, b~~Both MRI and CT are approvable)**[23, 24] ~~(ACR, 2021; Koivikko, 2008)~~
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation
- When office notes specify the patient meets NEXUS (National Emergency X-Radiography Utilization Study) or CCR (Canadian Cervical Rules) criteria for imaging[22] ~~(ACR, 2018)~~:
    - CT for initial imaging
    - MRI when suspect spinal cord or nerve root injury or when patient is obtunded, and CT is negative
    - CT or MRI for treatment planning of unstable spine

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations"[22] ~~(ACR, 2018)~~)

For evaluation of known fracture or known/new compression fractures with worsening neck pain[22, 25]

~~(ACR, 2018)~~

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments
- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal **neurologic deficit** as above[26] ~~(Alexandru, 2012)~~
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: W~~is indicated when signs and symptoms are incongruent with MRI findings or hen~~ MRI cannot be performed/contraindicated/surgeon preference[13, 27-31]

- ~~(Grams, 2010; Morita, 2011; Naganawa, 2011; NASS, 2012; Ozdoba; 2011; Starling, 2013)~~

- **When signs and symptoms inconsistent or not explained by the MRI findings**
- Demonstration of the site of a CSF 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)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac
- Evaluation of suspected brachial plexus or nerve root injury in the neonate

For evaluation of tumor, cancer, or metastasis with any of the following:

~~-~~(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[32-34]

~~(ACR, 2108; Kim, 2012; Roberts, 2010)~~

- **Primary tumor**
  - Initial staging or re-staging of a known primary spinal tumor[35] ~~(NCCN 2021)~~
  - Known spinal 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[26] ~~(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[26] ~~(Alexandru, 2012)~~
  - **Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck 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**~~Initial imaging of new or increasing non-traumatic neck pain or radiculopathy or neck 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[34, 36] ~~(ACR, 2018; Ziu, 2019)~~

- **For evaluation of inconclusive/indeterminate 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. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding[34] ~~(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 when Cervical Spine MRI is contraindicated[37]

~~(ACR, 2018)~~

- As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[38] ~~(Bond, 2016)~~
- Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[39] ~~(Berbari, 2015)~~

For evaluation of known or suspected inflammatory disease or atlantoaxial instability when MRI is contraindicated or for surgical treatment planning:

- In rheumatoid arthritis with neurologic signs/symptoms, or evidence of subluxation on radiographs (lateral radiograph in flexion and neutral should be the initial study)[40, 41] ~~(Colebatch, 2013; Tehranzadeh, 2017)~~
    - Patients with negative radiographs but symptoms suggestive of cervical instability or in patients with neurologic deficits
- High-risk disorders affecting the atlantoaxial articulation, such as Down syndrome, Marfan syndrome with neurological signs/symptoms, abnormal neurological exam, or evidence of abnormal or inconclusive radiographs of the cervical spine[42] ~~(Henderson, 2017)~~
- Spondyloarthropathies, known or suspected
    - 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 when Cervical Spine MRI is contraindicated[37, 43]

~~(ACR, 2015; Nagashima, 2010)~~

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

Other Indications for a Cervical Spine CT, when MRI is contraindicated or cannot be performed

(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[44-46] ~~(AANS, 2019; Duz, 2008; Milhorat, 2009)~~

- Known Arnold-Chiari syndrome- (For initial imaging 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[47] ~~(Hitson, 2015)~~
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
    - Achondroplasia (one Cervical Spine MRI to assess the craniocervical junction, as early as possible (even in asymptomatic cases)[48, 49] ~~(Legare, 2020; White, 2016)~~
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis ~~(Timpone, 2015)~~)[50]~~,~~
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- **Toe walking in a child with signs/symptoms of myelopathy localized to the Cervical Spine**
- **Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)**
    - **After detailed neurological exam and basic testing completed**
- ~~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))~~

COMBINATION STUDIES WITH CERVICAL SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

~~**Indications for combination studies[48,49]:** (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**~~

Brain CT/Cervical CT

- For evaluation of known Arnold-Chiari Malformation

Cervical and Thoracic CT

- **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 CTs:

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

- **Any combination of these studies for:**

- Survey/complete initial assessment of 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)
- In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[56]
- Back pain 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]:
  - 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[58, 59]
  - 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[44, 53]
  - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
    - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[44-46] ~~40-42~~ when anesthesia required for imaging[60]~~54~~ (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
  - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See ~~Background~~**Overview**
  - Suspected leptomeningeal carcinomatosis (LC)[61]- See ~~Background~~**Overview**
  - 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 -preferred exam CT myelogram))[13]
- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT
- ~~Any combination of these studies for:~~
  - ~~Scoliosis survey in infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (ACR, 2018; SRS, 2019; Strahle, 2015).~~
  - ~~In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53] (Trenga, 2016)~~

- Neck pain and vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging.
- Scoliosis with any of the following[54] (Ozturk, 2010):
  - Progressive spinal deformity;
  - Neurologic deficit;
  - 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 I[55, 56] (Radic, 2018; Strahle, 2011)
  - 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[41, 52] (Milhorat, 2009; Strahle, 2015)
- Arnold Chiari II-IV
  - 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,[41-43] (AANS, 2019; Duz, 2008; Milhorat, 2009), when anesthesia required for imaging[57] (Hertzler, 2010)
- 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))
- Neck 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[8, 9] (Bernstein, 2007; Feldman, 2006)
  - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)
  - Suspected leptomeningeal carcinomatosis (LC)[58] (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 -preferred exam CT myelogram)[12] (Starling, 2013)
  - CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
  - Post-procedure (discogram) CT

BACKGROUND

Computed tomography (CT) is performed for the evaluation of the cervical spine. CT may be used as the primary imaging modality, or it may complement other modalities. Primary indications for CT include conditions, e.g., traumatic, neoplastic, and infectious. CT is often used to study the cervical spine for conditions such as degenerative disc disease when MRI is contraindicated. CT provides excellent depiction of bone detail and is used in the evaluation of known fractures of the cervical spine and for evaluation of postoperative patients.

OVERVIEW

***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[12, 62] ~~(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%)[63] ~~(Graeber, 2019)~~
- High risk populations (indwelling hardware, history of endocarditis, IVDA, recent procedures) with appropriate signs/symptoms

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%).[18]

CT and Infection of the spine – Infection of the spine is not easy to differentiate from other spinal disorders, e.g., degenerative disease, spinal neoplasms, and non-infective inflammatory lesions. Infections may affect different parts of the spine, e.g., vertebrae,

intervertebral discs, and paraspinal tissues. Imaging is important to obtain early diagnosis and treatment to avoid permanent neurologic deficits. When MRI is contraindicated, CT may be used to evaluate infections of the spine.

Table 1: Gait and spine imaging[64-69]‡

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	~~• EMGà foot drop Lumbar spine MRI~~ ~~• Pelvis MR appropriate evidence of plexopathy~~ 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
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)~~

~~**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%) (Vilaca, 2016).[18]~~

~~**CT and Infection of the spine** – Infection of the spine is not easy to differentiate from other spinal disorders, e.g., degenerative disease, spinal neoplasms, and non-infective inflammatory lesions. Infections may affect different parts of the spine, e.g., vertebrae, intervertebral discs, and paraspinal tissues. Imaging is important to obtain early diagnosis and treatment to avoid permanent neurologic deficits. When MRI is contraindicated, CT may be used to evaluate infections of the spine.~~

CT and Degenerative Disc Disease – Degenerative disc disease is very common, and CT may be indicated when MRI is contraindicated, when chronic degenerative changes are accompanied by conditions, e.g., new neurological deficits; onset of joint tenderness of a localized area of the spine; new abnormal nerve conductions studies; exacerbation of chronic neck or back pain unresponsive to conservative treatment; and unsuccessful physical therapy/home exercise program.

Ossification Posterior Longitudinal Ligament (OPLL)[16] ~~(Choi, 2011)~~ – Most common in cervical spine (rare but more severe in thoracic spine).

Table 2: MRI and Cutaneous Stigmata[70] ~~(Dias, 2015)~~

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • A~~r~~tretic 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.		

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)~~."[25]

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)~~.[36]

Cervical Spine Trauma Imaging[22] ~~(ACR, 2018):~~ – The National Emergency X-Radiography Utilization Study (NEXUS) and the Canadian Cervical Rules (CCR) represent clinical criteria used to help determine the presence of significant cervical spine injury. Although the criteria are highly sensitive (99.6% for NEXUS), specificity is low (12.9% for Nexus).

A patient not meeting any of the NEXUS criteria of focal neurologic deficit, midline spinal tenderness, altered consciousness, intoxication or distracting injury is unlikely to have a

significant cervical spine injury. Imaging evaluation of the cervical spine in these patients is not necessary. In the CCR criteria, a patient without any high risk factors (Age >65 years; paresthesias in extremities; dangerous mechanism; falls from ≥3 feet/5 stairs; axial load to head; motor vehicle crash with high speed, rollover, or ejection; bicycle collision; motorized recreational vehicle accident) is next evaluated for low risk factors (simple rear-end motor vehicle crash, patient in sitting position in emergency center, patient ambulatory at any time after trauma, delayed onset of neck pain, absence of midline cervical spine tenderness). If the patient meets a low ~~-~~risk criteria, they are asked to move their head 45 degrees from midline in both directions. If the patient can accomplish this, the spine is cleared, and imaging is not necessary.

CT Myelogram –

Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI due to its non-invasiveness and superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated or nondiagnostic, brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak ~~(ACR, 2019; Pomerantz, 2016)~~.[71, 72]

Drop Metastases[73] – 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[74] – Leptomeningeal carcinomatosis is a 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, 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 no related to plexopathy or peripheral neuropathy** ○ **Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem** ○ **Clarified isolated neck pain in pediatric patient** ○ **Clarified CT myelogram section** ○ **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 cervical 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
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 and surgeon preference for exam type ○ 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 ○ Added Achondroplasia to criteria
May 2020	• Added ○ For evaluation of neurologic deficits when Cervical Spine MRI is contraindicated or inappropriate, added "new" deficits ○ Expanded CT myelogram indications ○ Added Imaging of Ossification of the Posterior Longitudinal Ligament (OPPL) ○ Added imaging in high risk patients predisposed to spinal injury ○ Added imaging in high risk patients for atlantoaxial injury ○ Added to background of imaging of infection ○ Modified Initial imaging of new or increasing non-traumatic neck pain or radiculopathy or to include 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 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 ○ CT myelogram ○ Rheumatoid arthritis ○ Specifics on neuro deficits including pathologic reflexes and spasticity, sensory, or motor level ○ Spinal trauma ○ New or increasing back pain in cancer patients with high suspicion of mets

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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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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.