AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guideline **CERVICAL SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72141, 72142, 72156	**Last Revised Date: ~~May~~ April 2021~~0~~**
Guideline Number: NIA_CG_040	**Implementation Date: January 2022~~1~~**

INDICATIONS FOR CERVICAL SPINE MRI
(Combination requests at end of the document)

For evaluation of neurologic deficits*
(Acharya, 2019; ACR, 2013; NASS, 2010; ~~Acharya, 2019,~~ Stolper, 2017; Teoli, 2021)

- **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**
  - **Upper or lower extremity increase muscle tone/spasticity**
  - **New onset bowel or bladder dysfunction (e.g., retention or incontinence)**
  - **Gait abnormalities (see ~~table below~~Table 1 for more details*)**
- **Suspected cord compression with any neurological deficits* as listed above~~.~~**

For evaluation of neck pain with any of the following
(**Allegri, 2016; AANSCNS, 2014; Jarvik, 2015**~~Allegri, 2016~~)

- With new or worsening objective **neurologic deficits*** on exam
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months (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))~~.~~
- **Isolated neck pain in pediatric population (ACR, 2016) – conservative care not required if red flags present (see combination request below thoracic and lumbar spine may also be indicated)**

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

- 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; 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 (Bernstein, 2007; Feldman, 2006).
- Neck pain associated with suspected inflammation, infection, or malignancy

~~For evaluation of neurologic deficits~~
~~(ACR, 2013; NASS, 2010)~~

- ~~With any of the following new neurological deficits: extremity muscular weakness; pathologic (e.g., Babinski, Chaddock Sign, Hoffman's) or abnormal reflexes; or abnormal sensory changes along a particular dermatome (nerve distribution) as documented on physical exam; bowel or bladder dysfunction; spasticity, sensory, or motor level (Acharya, 2019).~~

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

- ~~For preoperative evaluation/planning.~~
-
- 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))
- 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~~.~~
- Residual or new ~~or recurrent symptoms with any of the following~~ neurological deficits or symptoms~~: upper extremity weakness, objective sensory loss, or abnormal reflexes~~ (Rao, 2018)- see neurological deficit section above~~*.~~
- When combo requests are submitted (~~e.g.~~e.g.,~~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.,~~i.e~~ the need for both soft tissue and bony anatomy is required) (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)~~–~~(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 (i.e., surgical approach) for the patient.

For evaluation of suspected myelopathy
(ACR, 2015; Behrbalk, 2013; Davies, 2018; **Sarbu, 2010**; Vilaca, 2016~~, Sarbu, 2010~~)

- Does ~~not~~ NOT require conservative care
- ~~Concurrent cervical/thoracic imaging not recommended~~
- 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**.
- ~~Signs: unsteadiness, broad-based gait, increased muscle tone, weakness and wasting of the upper and lower limbs; diminished sensation to light touch, temperature, proprioception, vibration; limb hyperreflexia and pathologic reflexes (upper or lower extremity); bowel and bladder dysfunction in more severe cases.~~

For evaluation of known or suspected multiple sclerosis (MS)
(ACR, 2015; **CSMS, 2018**; Filippi, 2016; **Kaunzner, 2017**)

-
- Evidence of MS on recent baseline Brain MRI.
- **Suspected or known pediatric demyelinating diseases (MS/ADEM)**
- Suspected **or known** MS with new or changing symptoms consistent with cervical spinal cord disease (focal neurologic deficit or clinical sign, e.g., Lhermitte sign).
- ~~Follow-up of known Multiple Sclerosis.~~
- ~~Follow-up to the initiation or change in medication for patient with known Multiple Sclerosis.~~
- **Combination studies MS (Barakat, 2015)**
  - Cervical **and/or** Thoracic MRI for evaluation of suspected multiple sclerosis (MS) when Brain MRI does not fulfill diagnostic criteria (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) (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)**~~
  -
  - ~~**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)

- Presents with any of the following **neurological deficits*** ~~: muscle weakness, abnormal reflexes, and/or sensory changes along a particular dermatome (nerve distribution)~~ **noted above**~~.~~
- With progression or worsening of symptoms during the course of conservative treatment*~~.~~
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis**, diffuse idiopathic skeletal hyperostosis), both MRI and CT are approvable**~~.~~ **(ACR, 2021**; ~~Taljanovic ,~~Koivikko, 2008**; Taljanovic, 2009)**~~, ACR)~~
- When the patient is clinically unevaluable or there are preliminary imaging findings (xX~~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:
  - 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 i~~I~~t is appropriate to perform both examinations") (ACR, 2018)~~.~~

For evaluation of known or new compression fractures with worsening neck pain
(ACR, 2018)

- With history of malignancy
  - To aid in differentiation of benign osteop**o**~~e~~rotic fractures from metastatic disease
    - A follow-~~-~~up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher (indeterminate) benign osteop**o**~~e~~rotic fracture from metastatic disease (Kumar, 2016)
    -
- With an associated new focal **neurologic deficit* as above (Alexandru, 2012)**

Prior to a planned surgery/intervention or if the results of the MRI will change management~~.~~

-

For evaluation of known 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)
(ACR, 2018; Kim, 2012; Roberts, 2010)

Primary tumor~~:~~

- ~~For~~**Initial staging or re-**~~-~~staging of a known **primary spinal** tumor~~.~~
- ~~For follow-up evaluation of patients undergoing active cancer treatment.~~

- ~~Presents with~~Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings) ~~of new tumor or change in tumor.~~
- With an associated new focal neurologic deficit* as above (Alexandru, 2012)

Metastatic tumor~~:~~

- With evidence of metastasis on bone scan needing further clarification~~or previous imaging study~~ 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 (Alexandru, 2012)
- Initial imaging of new or increasing non-traumatic neck pain or radiculopathy or neck ~~that~~ 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 (ACR, 2018; Ziu, 2019)~~.~~

For evaluation of ~~suspected tumor~~ 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
- ~~-~~(ACR, 2018)

- ~~Prior abnormal or indeterminate imaging that requires further clarification.~~

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~~~~:~~
(ACR, 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 (Bond, 2016)~~.~~
  - Follow~~-~~-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings (Berbari, 2015)

For evaluation of known or suspected inflammatory disease or atlantoaxial instability~~:~~

- In rheumatoid arthritis with neurologic signs/symptoms, or evidence of subluxation on radiographs (lateral radiograph in flexion and neutral should be the initial study) (Colebatch, 2013; Tehranzadeh, 2017)
    - Patients with negative radiographs but symptoms suggestive of cervical instability or in patients with neurologic deficits MRI is indicated (Gillick, 2015)
- 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 (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
(ACR, 2015; Nagashima, 2010)

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

Other I~~Other I~~ndications for a Cervical Spine MRI
(Note- See combination requests**, below, for initial advanced imaging assessment and pre-operatively)**

- ~~For preoperative evaluation/planning.~~
- ~~Suspected cord compression with any of the following neurological deficits: extremity weakness; sensory deficits, abnormal gait; abnormal reflexes; spinal level; bowel or bladder incontinence.~~
- Tethered cord, or spinal dysraphism (known or suspected), based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata (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 ~~for~~ **with** new or changing signs/symptoms or exam findings **consistent with spinal cord pathology** (Hitson, 2015)
    - **Known Chiari II** ~~Chiari II (~~ **(Arnold-Chiari syndrome), III, or IV malformation**~~), III, or IV malformation.~~
    - **Achondroplasia (one Cervical Spine MRI to assess the craniocervical junction, as early as possible, ~~(~~even in asymptomatic cases)(Legare, 2020; White, 2016)**
- ~~Congenital abnormalities (Trenga, 2016):~~
    - ~~In the presence of neurologic deficit, progressive spinal deformity, or for preoperative planning (Trenga, 2016)~~
    - ~~Back 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:~~
        - ~~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

- 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));
  - 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))
  - CSF leak highly suspected and supported by patient history and/or physical exam findings.

For pediatric population (ACR, 2016)

- Red flags that prompt imaging should include the presence of constant pain, night pain, and radicular pain lasting for 4 weeks or more.
- Back pain associated with suspected inflammation, infection, or malignancy

Ossification Posterior Longitudinal Ligament (OPLL)

(Choi, 2011)

CT to evaluate the calcification and MR for evaluation of cord.

- Both CT and MRI would be approvable if surgery is planned, as signal changes in the cord would suggest a poorer prognosis after surgery anorectal

COMBINATION OF STUDIES WITH CERVICAL SPINE MR

I

ndications for combination studies: (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 MRI/Cervical MRI

- `For evaluation of known Arnold-Chiari Malformation**Brain MRI/Cervical MRI**

- For evaluation of Arnold Chiari malformation.

Any combination of Cervical and Thoracic Combination MRI

- Transverse Myelitis- with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days (Goh, 2011); elevated protein on cerebrospinal fluid (CSF) analysis)

Cervical and/or ~~/~~Thoracic and/or ~~/~~Lumbar MRIs~~:~~

- Any combination of these **studies** for:
    - ~~s~~Scoliosis survey in infant/child with congenital scoliosis or **juvenile idiopathic scoliosis** under the age of 10~~10~~ (ACR, 2018; SRS, 2019; Strahle, 2015)~~.~~
    - **In the presence of progressive spinal deformity~~,~~ or for preoperative planning (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 (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**
- ~~Any combination of these for spinal survey in patient with metastases.~~
- **Arnold-Chiari I (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** (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 (AANS, 2019; Duz, 2008; Milhorat, 2009), when anesthesia required for imaging.~~**Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata (AANS, 2019; Duz, 2008; Milhorat, 2009), when anesthesia required for imaging (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 (Bernstein, 2007; Feldman, 2006)**
    -
- Drop metastasis from brain or spine (imaging also includes brain)~~.~~
- Suspected ~~l~~Leptomeningeal carcinomatosis (LC) (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))
-

~~Cervical and Thoracic Combination MRI~~

- ~~Transverse Myelitis with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days (Goh, 2011); elevated protein on cerebrospinal fluid (CSF) analysis)~~

~~Cervical MRI/CT~~
~~For unstable craniocervical junction~~

~~Brain MRI/Cervical MRI~~

- ~~For evaluation of Arnold Chiari malformation.~~
- ~~For follow-up of known Multiple Sclerosis (MS) (Filippi, 2016).~~
- ~~Suspected MS with new or changing symptoms consistent with cervical spinal cord disease.~~
- ~~Follow up to the initiation or change in medication for patient with known Multiple Sclerosis~~

BACKGROUND

Magnetic resonance imaging (MRI) produces high quality multiplanar images of organs and structures within the body without radiation. It is the preferred modality for evaluating the internal structure of the spinal cord, providing assessment of conditions such as degenerative disc pathology, osteomyelitis, and discitis.

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 (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.

Cervical 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).

Infection, Abscess, or Inflammatory disease

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

Table 1: Gait and spine imaging‡

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→ 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)

Gait and spine imaging:

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Neurogenic	Steppage, dragging of toes	EMG → foot drop Lumbar spine MRI Pelvis MR appropriate if evidence of plexopathy
Vestibular	Insecure, veer to one side, worse when eyes closed, vertigo	Consider Brain/IAC MRI as per Brain GL

Infection, Abscess, or Inflammatory disease

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

MRI and Cutaneous Stigmata (Dias, 2015)

TABLE 1 Risk Stratification for Various Cutaneous Markers

High Risk	Intermediate Risk	Low Risk
Hypertrichosis	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
Infantile hemangioma		Light hair
Atretic meningocele		Isolated café au lait spots
DST		Mongolian spots
Subcutaneous lipoma		Hypo- and hypermelanotic macules or papules
Caudal appendage		Deviated or forked gluteal cleft
Segmental hemangiomas in association with LUMBAR syndrome		Nonmidline lesions

LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.

MRI for Evaluation of Discitis – Discitis is a known complication of cervical discography. Postoperative discitis in the cervical spine does not occur frequently but can result from accidental inoculation of bacteria into the disc space intra-operatively by a contaminated spinal needle being used as a radiological marker. There may be other causes for postoperative discitis, e.g., esophageal perforation, hematogenous spread, inoculation of bacteria during surgery. Patients with an alteration in the nature of their symptoms after cervical discectomy and fusion may have discitis. Symptoms may include complaints of mild paresthesia in extremities and neck pain. MRI may be performed to reveal feature of discitis with associated abscesses and may help to confirm the diagnosis and decide on ~~the~~ further management.

MRI for Cervical Radiculopathy – MRI is a useful test to evaluate the spine because it can show abnormal areas of the soft tissues around the spine; in addition to the bones, it can also show pictures of the nerves and discs and is used to find tumors, herniated discs, or other soft-tissue disorders. MRI has a role both in the pre-operative screening and post-operative assessment of radicular symptoms due to either disc or osteophyte.

Table 2: MRI and Cutaneous Stigmata (Dias, 2015)

Risk Stratification for Various Cutaneous Markers		
High Risk	**Intermediate Risk**	**Low Risk**
• Hypertrichosis • Infantile hemangioma • Artretic meningocele • DST	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots

• Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	when darker red and well-defined)	• 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.		

MRI and Multiple Sclerosis (MS) – MRI is a sensitive method of detecting the white matter lesions of MS. These plaques on MRI generally appear as multiple, well-demarcated, homogeneous, small ovoid lesions which often lack mass effect and are oriented perpendicular to the long axis of the lateral ventricles. Sometimes they present as large, space occupying lesions that may be misinterpreted as tumors, abscesses, or infarcts.

MRI and Neck Pain – Neck pain is common in the general population and usually relates to musculoskeletal causes, but it may also be caused by spinal cord tumors. When neck pain is accompanied by extremity weakness, abnormal gait, or asymmetric reflexes, spinal MRI may be performed to evaluate the cause of the pain. MRI may reveal areas of cystic expansion within the spinal cord. Enhancement with gadolinium contrast may suggest that the lesion is neoplastic.

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

Back Pain with Cancer History - Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. 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).

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. Spinal metastasis is more commonly found in the

thoracic region, followed by the lumbar region, while the cervical region is the least likely site of metastasis (Ziu, 2019).

Cervical Spine Trauma Imaging (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.

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 (Borofsky, 2013).
- 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 (Evans, 2017).
- In patients with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities (Krueger, 2013).
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years (Varshney~~on Hippel Lindau~~, 2017).
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only ~~after~~ age 1 and is recommended in patients <1 year old only if symptomatic (Comi, 2011).

POLICY HISTORY

Date	Summary
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 are new ○ 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 transverse myelitis ○ Modified 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 ○ Added to background of imaging of infection ○ 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 • Improved section for evaluation of multiple sclerosis including NMO disorders and recurrent transverse myelitis; Lhermitte sign • Modified section on evaluation of neurologic deficits; added specific pathologic findings; spasticity, sensory, or motor level changes • Included signs in section on myelopathy including hyperreflexia and pathologic reflexes • Enhanced sections on trauma; rheumatoid arthritis; back pain in cancer patients with known active cancer in tumors that tend to metastasize to spine • Expanded on tethered cord in Other Indications for imaging and added section on sacral dimple • For combination studies Brain/Cervical Spine added suspected MS with new or changing symptoms and follow up to initiation of treatment with known MS

~~June 2019~~

- ~~Added:~~
  - ~~new or worsening objective neuro deficits for chronic and acute back pain~~
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April 2021

- Added/modified
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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.

Reviewed / Approved by  M. Atif Khalid, M.D., Medical Director, Radiology