National Imaging Associates, Inc.*	
Clinical guidelines: **LUMBAR SPINE CT**	**Original Date: September 1997**
CPT Codes: 72131, 72132, 72133	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_045	**Implementation Date: January 2022**

INDICATIONS FOR LUMBAR SPINE CT
(Combination requests at end of the document)

For evaluation of neurologic deficits when Lumbar Spine MRI is contraindicated or inappropriate

- **With any of the following new neurological deficits documented on physical exam**
  - **Extremity muscular weakness**
  - **Pathologic or abnormal reflexes**
  - **Absent/decreased sensory changes along a particular lumbar dermatome (nerve distribution): pin prick, touch, vibration, proprioception or temperature**
  - **Lower extremity increased muscle tone/spasticity**
  - **New onset bowel or bladder dysfunction (e.g., retention or incontinence)**
  - **Gait abnormalities (see ~~table~~Table 1 below for more details*)**
  - **New onset foot drop**

Cauda Equina Syndrome as evidence by severe back pain/sciatica along with one of the defined symptoms (see Background section)

~~Cauda Equina Syndrome as evidence by severe back pain/sciatica along with one of the defined symptoms (see background section)~~

-

For evaluation of back pain with any of the following when Lumbar Spine MRI is contraindicated
(AAFP, 2012; AANSCNS, 2014; ACA, 2017; ACEP, 2014; ACR, 2015; Chou, 2007; Jarvik, 2015; Last, 2009; NASS, 2013)

- 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~~.~~
- With progression or worsening of symptoms during the course of conservative treatment*~~.~~

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

- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a lumbar radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain (NASS, 2013)).
-
- **Isolated back pain in pediatric population (ACR, 2016) – conservative care not required if red flags present (see combination request below cervical and thoracic spine may also be indicated)**
    - **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) .**
    - **Back pain associated with suspected inflammation, infection, or malignancy**

For evaluation of neurologic deficits when Lumbar Spine MRI is contraindicated or inappropriate

With any of the following new neurological deficits: lower extremity muscular weakness; abnormal reflexes; abnormal sensory changes along a particular dermatome (nerve distribution) as documented on exam; evidence of Cauda Equina Syndrome; bowel or bladder dysfunction; new foot drop.

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)

: [Note:

If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planningplanning, a. 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))(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.**
- **Residual or new neurological deficits or symptoms (Rao, 2018)- see neurological deficit section above*.**

- When combo requests 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, i.e., the need for both soft tissue and bony anatomy is required (Fisher, 2013).
    - Combination requests where both lumbar spine CT and MRI lumbar spine are both approvable (not an all-inclusive list):
        - 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 trauma or acute injury
(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 or diffuse idiopathic skeletal hyperostosis) both MRI and CT are approvable. (Koivikko, 2008)
- When the patient is clinically unevaluable or there are preliminary imaging findings (xX-ray or CT) needing further evaluation.

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

For evaluation of known fracture or known/new compression fractures
(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 (Alexandru, 2012)
- Prior to a planned surgery/intervention or if the results of the CT will change management.

~~For evaluation of known fracture~~

- ~~To assess union of a fracture where physical examination, plain radiographs, or prior imaging suggests delayed or non-healing~~
- ~~To determine position of known fracture fragments.~~

CT myelogram is indicated when signs and symptoms are incongruent with MRI findings or MRI cannot be performed/contraindicated /surgeon preference
(Grams, 2010; Morita, 2011; Naganawa, 2011; NASS, 2012; Ozdoba; 2011)

- **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.**
- ~~**For evaluation of trauma or acute injury**~~
- ~~(ACR, 2018; Chou, 2007, Koivikko, 2008)~~
- ~~Presents with any of the following neurological deficits: radiculopathy, muscle weakness, abnormal reflexes, and/or sensory changes along a particular dermatome (nerve distribution)].~~
- ~~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 (DISH))~~

Pars defect (spondylolysis) or spondylolisthesis

- Pars defect (spondylolysis) or spondylolisthesis in adults when Flexion/Extension x-rays show instability.
- Clinically suspected Pars defect (spondylolysis) which is not seen on plain films in pediatric population (<18 yr) (flexion extension instability not required) and imaging would change treatment (Cohen, 2005; Kobayashi, 2013; Rush, 2015) when MRI is contraindicated.

NOTE: Initial imaging (x-ray, or planar bone scan without SPECT; Bone scan with SPECT is superior to MRI and CT in the detection of pars intrarticularis pathology including spondylolysis) (Matesan, 2016).

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

- ~~With history of malignancy when MRI is contraindicated.~~
- ~~With an associated new focal neurologic deficit~~
- ~~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- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)
(Kim, 2012; McDonald, 2019)

Primary tumor

- **Initial staging or re-staging of a known primary spinal tumor.**
- **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 (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 (Alexandru, 2012)**
- **Initial imaging of new or increasing non-traumatic neck pain or radiculopathy ~~or~~or neck pain that ~~pain~~ 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, 202~~019~~).**

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 or is contraindicated or CT is preferred to characterize the finding (ACR, 2018)**
- ~~For evaluation of known tumor, cancer, or evidence of metastasis with any of the following (Last, 2009) (MRI is usually the preferred study, but CT may help characterize solitary indeterminate bone lesions) (Kim, 2012)~~
- ~~For staging of known tumor.~~
- ~~For follow-up evaluation of patient undergoing active cancer treatment.~~
- ~~Presents with new signs or symptoms (e.g., physical, laboratory, and/or imaging findings) of new tumor or change in tumor.~~
- ~~With evidence of metastasis on bone scan or previous imaging study.~~
- ~~Initial imaging of new or increasing non-traumatic back pain or radiculopathy or back that pain 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 when Lumbar Spine MRI is contraindicated or inappropriate~~
~~(ACR, 2015)~~

- ~~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 when Lumbar Spine MRI is contraindicated
(ACR, 2015; Last, 2009; 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 (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 when MRI is contraindicated or cannot be performed:
(ACR, 2021)

- **For known or suspected Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup**

~~For known or suspected Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup~~

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma, and Lumbar Spine MRI is contraindicated
(ACR, 2015)

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

~~**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)**~~

- ~~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.~~
- ~~Changing neurologic status post-operatively.~~
- ~~Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings.~~
- ~~Residual or recurrent symptoms with any of the following neurological deficits: Lower extremity weakness, objective sensory loss, or abnormal reflexes (Rao, 2018).~~

Other Indications for a Lumbar Spine CT, when MRI is contraindicated or cannot be performed
(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

~~**Other indications for a Lumbar Spine CT**~~

- ~~For preoperative evaluation and Lumbar Spine MRI is contraindicated~~
- ~~CT discogram.~~
- **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 anorectal malformations (Kim, 2010; Morimoto, 2003)**

- **Suspicious sacral dimple (those that are deep, larger than 0.5 cm, located within the superior portion of the gluteal crease or above the gluteal crease, multiple dimples, or associated with other cutaneous markers) (D'Alessandro, 2009) or duplicated or deviated gluteal cleft (Zywicke, 2011)**
    - **in patients <3 months should have ultrasound.**
- **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))**
- **Known Chiari II ~~Chiari II (~~ (Arnold-Chiari syndrome), III, or IV malformation ~~), III, or IV malformation.~~**
- **For follow-up/repeat evaluation of Arnold-Chiari I with new signs or symptoms suggesting recurrent spinal cord tethering (For initial diagnosis see below)**
    - ~~Suspicious sacral dimple (those that are deep, larger than 0.5 cm, located within the superior portion of the gluteal crease or above the gluteal crease, or associated with other cutaneous markers) (Choi, 2018; D'Alessandro, 2009) in patients < 6 months should have ultrasound) when **Lumbar Spine MRI is contraindicated**.~~
    - ~~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 **Lumbar Spine MRI is contraindicated.**~~
    - ~~For suspected Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup~~
- ~~Known Arnold-Chiari syndrome and **Lumbar Spine MRI is contraindicated** (Milhorat, 2009; Strahle, 2015).~~
- ~~Congenital abnormalities when **Lumbar Spine MRI is contraindicated** or for characterization of boney detail (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 degree kyphosis, left thoracic curve, associated organ anomalies);~~
        - ~~Pre-operative planning; OR~~
        - ~~When office notes clearly document how imaging will change management.~~
- ~~CSF leak highly suspected and supported by patient history and/or physical exam findings (CT Myelogram)~~
- ~~For pediatric population if MRI is contraindicated (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 and initial radiographs preformed (ACR, 2016).~~

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

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

Indications 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

Any combination of Cervical and/or Thoracic and/or Lumbar CTs:
~~**Cervical/Thoracic/Lumbar CTs:**~~

- **Any combination of these studies for:**
  - **Scoliosis survey in infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10 (ACR, 2018; SRS, 2019; Strahle, 2015).**
  - **In the presence of neurological 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 (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 (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 is required for imaging (Hertzler, 2012).**
- **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 (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 ~~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 -preferred exam CT myelogram))(Starling, 2013)**
- **CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning**
- **Post-procedure (discogram) CT**
- ~~CT myelogram or discogram~~
- ~~Any combination of these for scoliosis survey in infant/child when MRI is contraindicated (Strahle, 2015).~~
- ~~Any combination of these for spinal survey in patient with metastasis.~~
- ~~For evaluation of spinal abnormalities associated with Arnold-Chiari Malformation (C/T/L spine due to association with tethered cord and syringomyelia) (Milhorat, 2009; Strahle, 2015) and **Lumbar Spine MRI is contraindicated**.~~
- ~~Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or cutaneous stigmata (AANS 2019; Duz, 2008; Milhorat, 2009; NIH), when anesthesia required for imaging and **MRI is contraindicated.**~~
- ~~Drop metastasis from the brain or spine **when MRI contraindicated** (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram).~~
- ~~CSF leak highly suspected and supported by patient history and/or physical exam findings~~

BACKGROUND

Computed tomography is used for the evaluation, assessment of severity, and follow-up of diseases of the spine. Its use in the thoracic spine is limited, however, due to the lack of epidural fat in this part of the body. CT myelography improves the contrast severity of CT, but it is also invasive. CT may be used for conditions, e.g., degenerative changes, infection, and immune suppression, when magnetic resonance imaging (MRI) is contraindicated. It may also

be used in the evaluation of tumors, cancer, or metastasis in the thoracic spine, and it may be used for preoperative and post-surgical evaluations. CT obtains images from different angles and uses computer processing to show a cross-section of body tissues and organs. CT is fast and is often performed in acute settings. It provides good visualization of cortical bone.

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 (Akgul, 2011; Bennett, 2010; Ostergaard, 2012; Seiper, 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 sacroilitis, peripheral inflammatory arthritis, and/or inflammatory bowel disease.

***Conservative Therapy:** (spine) This 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**, regular Osteopathic Manipulative medicine treatments 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.

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)

Table 2: CT and Cutaneous Stigmata (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.		

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.

CT and Fracture of the Lumbar Spine – CT scans of the lumbar spine generate high-resolution spinal images; this and the absence of superimposed structures allow accurate diagnosis of lumbar fractures.

CT and Radiculopathy –Lumbar radiculopathy is caused by compression of a nerve root and/or inflammation that has progressed enough to cause neurologic symptoms, e.g., numbness, tingling, and weakness in leg muscles. These are warning signs of a serious medical condition which needs medical attention. Multidetector CT may be performed to rule out or localize lumbar disk herniation before surgical intervention, when MRI is contraindicated. Radiation dose should be kept as low as possible in young individuals undergoing CT of the lumbar spine.

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 **to** early diagnose and treat **so as**~~ment~~ to avoid permanent neurology deficits. When MRI is contraindicated, CT may be used to evaluate infections of the spine.

CT and Degenerative Disease of the Lumbar Spine – Stenosis of the lumbar canal may result from degenerative changes of the discs, ligaments and facet joints surrounding the lumbar canal. Compression of the microvasculature of the bundle of nerve roots in the lumbosacral spine may lead to significant effects on the cauda equina. This is a surgical emergency, and CT may be performed to help assess the problem when MRI is contraindicated or inappropriate. CT scans can provide visualization of the vertebral canal and may demonstrate encroachment of the canal by osteophytes, facets, pedicles, or hypertrophied lamina.

Infection, Abscess, or Inflammatory disease

- 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

CT and Low Back Pain – Low back pain by itself is a self-limited condition which does not warrant any imaging studies. One of the “red flags” signifying a more complicated status is focal neurologic deficit with progressive or disabling symptoms. When magnetic resonance imaging (MRI) is contraindicated, CT of the lumbar spine with or without contrast is indicated for low back pain accompanied by a “red flag” symptom. Myelography combined with post-myelography CT is accurate in diagnosing disc herniation and may be useful in surgical planning. CT may be indicated when MRI is contraindicated, and chronic back pain unresponsive to conservative treatment; and unsuccessful physical therapy/home exercise program.

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 my~~l~~elomeningocele and lipomyelomeningocele; the following are other causes 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

Sacral Dimples - Simple midline dimples are the most commonly encountered dorsal cutaneous stigmata in neonates and indicate low risk for spinal dysraphism. Only atypical dimples are associated with a high risk for spinal dysraphism, particularly those that are large (>5 mm), high on the back (>2.5 cm from the anus), or appear in combination with other lesions (D' Alessandro, 2009). High-risk cutaneous stigmata in neonates include hemangiomas, upraised lesions (i.e., masses, tails, and hairy patches), and multiple cutaneous stigmata **(Table 2).**

Spina Bifida Occulta (AANS, 2020)

- Called the hidden spina bifida, as the spinal cord and the nerves are usually normal and there is no opening on the skin on the back.
- This subtype occurs in about 12% of the population and the majority of people are not aware that they have spina bifida occulta, unless it is discovered on an x-ray performed for an unrelated reason.
- Approximately 1 in 1,000 individuals can have an occult structural finding that leads to neurological deficits or disabilities as bowel or bladder dysfunction, back pain, leg weakness or scoliosis.

Back Pain with Cancer - **History** Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history. 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 tumor can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process (Ziu, 2019).

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.

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
- This is a "Red Flag" situation and Lumbar Spine MRI is approvable.

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 anorectal malformations
May 2020	• For evaluation of neurologic deficits added new deficits • Added ankylosing spondylitis for evaluation of trauma/acute injury • Added Osteopathic Manipulative medicine to conservative care therapy • 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 • Modified Pars fracture to not seen on radiograph and imaging would change management • Combined the acute and chronic back pain sections • Added spina bifida occulta to background section
June 2019	• Added CT myelogram • Added new or worsening objective neuro deficits for chronic and acute back pain • Added last 6 months for allowable post op follow up period and removed EMG comment • Added section on pars defect • Added section on compression fractures • In other indications removed myelogram since covered previously • Added congenital anomalies • Added sacral dimple and scoliosis • Added red flags specifically for peds back pain and pain related to malignancy, infection, inflammation • Added CSF leak indication • For combination studies C/T/L added drop metastasis, tethered cord, Arnold Chiari

~~June 2019~~

- ~~Added CT myelogram~~
- ~~Added new or worsening objective neuro deficits for chronic and acute back pain~~
- ~~Added last 6 months for allowable post op follow up period and removed EMG comment~~
- ~~Added section on pars defect~~
- ~~Added section on compression fractures~~
- ~~In other indications removed myelogram since covered previously~~
- ~~Added congenital anomalies~~
- ~~Added sacral dimple and scoliosis~~
- ~~Added red flags specifically for peds back pain and pain related to malignancy, infection, inflammation~~
- ~~Added CSF leak indication~~
- ~~For combination studies C/T/L added drop metastasis, tethered cord, Arnold Chiari~~

~~May 2020~~

- ~~For evaluation of neurologic deficits added new deficits~~
- ~~Added ankylosing spondylitis for evaluation of trauma/acute injury~~

- Added Osteopathic Manipulative medicine to conservative care therapy
- 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
- Modified Pars fracture to not seen on radiograph and imaging would change management
- Combined the acute and chronic back pain sections
- Added spina bifida occulta to background 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 anorectal malformations

REFERENCES

Akgul, O, Ozgocmen S. Classification criteria for spondyloarthropathies. *World J Orthop*. December 18, 2011; 2(12):107-115. doi: 10.5312/wjo.v2.i12.07. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3302034/.

Alexandru D. Evaluation and management of vertebral compression fractures. *Perm J*. Published online October 30, 2012:46-51. doi:10.7812/TPP/12-037.

American Academy of Family Physicians (AAFP). Fifteen Things Physicians and Patients Should Question. Choosing Wisely®. http://www.choosingwisely.org/societies/american-academy-of-family-physicians/. Published April 4, 2012.

American Association of Neurological Surgeons (AANS). Spina Bifida. 2020.

American Association of Neurological Surgeons (AANS). Tethered Spinal Cord Syndrome. http://www.aans.org/Patients/Neurosurgical-Conditions-and-Treatments/Tethered-SpinalCord-Syndrome. 2019.

American Association of Neurological Surgeons and Congress of Neurological Surgeons (AANSCNS). Five Things Physicians and Patients Should Question. Choosing Wisely®. http://www.choosingwisely.org/clinician-lists/american-association-neurological-surgeons-imaging-for-nonspecific-acute-low-back-pain/. Published June 24, 2014.

American Chiropractic Association (ACA). Five Things Physicians and Patients Should Question. Choosing Wisely®. http://www.choosingwisely.org/societies/american-chiropractic-association/. Published August 15, 2017.

American College of Emergency Physicians (ACEP). Ten Things Physicians and Patients Should Question. Choosing Wisely®. http://www.choosingwisely.org/societies/american-college-of-emergency-physicians/. Published October 27, 2014.

American College of Radiology (ACR). ACR Appropriateness Criteria®. http://www.acr.org/Quality-Safety/Appropriateness-Criteria/Diagnostic. Published 2015.

American College of Radiology (ACR). ACR Appropriateness Criteria®. Back Pain – Child. https://acsearch.acr.org/docs/3099011/Narrative/. Published 2016.

American College of Radiology (ACR). ACR Appropriateness Criteria®. Inflammatory Back Pain: Known or Suspected Axial Spondyloarthritis. https://acsearch.acr.org/docs/3094107/Narrative/. Revised 2021.

Bennett AN, Marzo-Ortega H, Rehman A, et al. The evidence for whole-spine MRI in the assessment of axial spondyloarthropathy. *Rheumatology*. March 2010; 49(3):426-432.

https://doi.org/10.1093/rheumatology/kep427.
https://academic.oup.com/rheumatology/article/49/3/426/1787410.

Berbari EF, Kanj SS, Kowalski TJ, et al. 2015 Infectious Diseases Society of America (IDSA) Clinical Practice Guidelines for the Diagnosis and Treatment of Native Vertebral Osteomyelitis in Adults. *Clin Infect Dis.* 2015 Sep 15; 61(6):e26–e46.

Bernstein RM, Cozen H. Evaluation of back pain in children and adolescents. *Am Fam Physician*. 2007;76(11):1669-1676.

Bond A, Manian FA. Spinal epidural abscess: A review with special emphasis on earlier diagnosis. Biomed Res Int. 2016; 2016:1614328.

Chhetri SK, Gow D, Shaunak S, Varma A. Clinical assessment of the sensory ataxias; diagnostic algorithm with illustrative cases. *Pract Neurol*. 2014;14(4):242-251. doi:10.1136/practneurol-2013-000764.

Chou R, Qaseem A, Snow V, et al. Diagnosis and treatment of low back pain: A joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med*. October 2, 2007; 147(7):478-491. http://annals.org/article.aspx?volume=147&issue=7&page=478.

Clinch J, Wood M, Driscoll S. Evaluation of gait disorders in children. BMJ Best Practice. Published February 23, 2021. Accessed July 14, 2021. https://bestpractice.bmj.com/topics/en-us/709.

Cohen E, Stuecker RD. Magnetic resonance imaging in diagnosis and follow-up of impending spondylolysis in children and adolescents: Early treatment may prevent pars defects. *J Pediatr Orthop B.* 2005; 14(2):63-67.

D' Alessandro D. Does This Sacral Dimple Need to be Evaluated? PediatricEducation.org™. Iowa City, IA: July 20, 2009. https://pediatriceducation.org/2009/07/20/does-this-sacral-dimple-need-to-be-evaluated/. Retrieved March 29, 2018.

Davis PC, Wippold FJ, Brunberg JA, et al. ACR appropriateness criteria on low back pain. *J Am Coll Radiol*. 2008; 6:401-407. doi: 10.1016/j.jacr.2009.02.008.

Dias M, Partington M. Congenital brain and spinal cord malformations and their associated cutaneous markers. Pediatrics. 2015; 136(4):e1105-19.

Duz B, Gocmen S, Secer HI, et al. Tethered cord syndrome in adulthood. *J Spinal Cord Med.* 2008; 31(3):272-278. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2565560/. Retrieved March 29, 2018.

Feldman DS, Straight JJ, Badra MI, Mohaideen A, Madan SS. Evaluation of an algorithmic approach to pediatric back pain. *J Pediatr Orthop*. 2006;26(3):353-357. doi:10.1097/01.bpo.0000214928.25809.f9.

Fisher BM, Cowles S, Matulich JR, Evanson BG, Vega D, Dissanaike S. Is magnetic resonance imaging in addition to a computed tomographic scan necessary to identify clinically significant cervical spine injuries in obtunded blunt trauma patients? *Am J Surg*. 2013;206(6):987-993; discussion 993-994. doi:10.1016/j.amjsurg.2013.08.021.

Gait abnormalities. Stanford Medicine 25. Published 2021. Accessed July 14, 2021. https://stanfordmedicine25.stanford.edu/the25/gait.html.

Graeber A, Cecava ND. Vertebral Osteomyelitis. [Updated 2019 Jun 3]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan.

Grams AE, Gempt J, Förschler A. Comparison of spinal anatomy between 3-Tesla MRI and CT-myelography under healthy and pathological conditions. *Surg Radiol Anat*. 2010; 32(6):581–585.

Haynes KB, Wimberly RL, VanPelt JM, Jo C-H, Riccio AI, Delgado MR. Toe walking: A neurological perspective after referral from pediatric orthopaedic surgeons. *Journal of Pediatric Orthopaedics*. 2018;38(3):152-156. doi:10.1097/BPO.0000000000001115.

Hertzler DA, DePowell JJ, Stevenson CB, Mangano FT. Tethered cord syndrome: A review of the literature from embryology to adult presentation. *Neurosurg Focus*. 2010;29(1):E1. doi:10.3171/2010.3.FOCUS1079.

Jarvik JG, Gold LS, Comstock BA, et al. Association of early imaging for back pain with clinical outcomes in older adults. *JAMA*. 2015; 313(11):1143-1153. doi: 10.1001/jama.2015.1871.

Kim SM, Chang HK, Lee MJ, et al. Spinal dysraphism with anorectal malformation: Lumbosacral magnetic resonance imaging evaluation of 120 patients. *Journal of Pediatric Surgery*. 2010;45(4):769-776. doi:10.1016/j.jpedsurg.2009.10.094.

Kim YS, Han IH, Lee IS, et al. Imaging findings of solitary spinal bony lesions and the differential diagnosis of benign and malignant lesions. *J Korean Neurosurg Soc.* August 2012; 52(2):126-132. doi: 10.3340/jkns.2012.52.2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3467370/. Retrieved March 29, 2018.

Kobayashi A, Kobayashi T, Kato K, et al. Diagnosis of radiographically occult lumbar spondylolysis in young athletes by magnetic resonance imaging. *Am J Sports Med.* 2013; 41(1):169-176.

Koivikko MP, Koskinen SK. MRI of cervical spine injuries complicating ankylosing spondylitis. Skeletal Radiol. 2008 Sep;37(9):813-9. doi:10.1007/s00256-008-0484-x. Epub 2008 Apr 18.

Last AR, Hulbert K. Chronic low back pain: Evaluation and management. *Am Fam Physician*. 2009; 79(12):1067-74.

Lerner S, Hartmann S, Barbagallo GMV, et al. Management of spinal infection: A review of the literature. *Acta Neurochir (Wien)*. 2018; 160(3): 487-496.

Marshall FJ. Approach to the elderly patient with gait disturbance. *Neurol Clin Pract*. 2012;2(2):103-111. doi:10.1212/CPJ.0b013e31825a7823.

Matesan M, Behnia F, Bermo M, et al. SPECT/CT bone scintigraphy to evaluate low back pain in young athletes: common and uncommon etiologies. *J Orthop Surg Res*. 2016; 11:76.

McDonald MA, Kirsch CFE, Amin BY, et al. ACR Appropriateness Criteria® cervical neck pain or cervical radiculopathy. *J Am Coll Radiol*. 2019;16(5S):S57-S76. doi:10.1016/j.jacr.2019.02.023.

Milhorat TH, Bolognese PA, Nishikawa M, et al. Association of Chiari malformation type I and tethered cord syndrome: preliminary results of sectioning filum terminale. *Surg Neurol*. July 2009; 72(1):20-35. **http://europepmc.org/abstract/med/19559924.**

Morimoto K, Takemoto O, Wakayama A. Tethered cord associated with anorectal malformation. *Pediatr Neurosurg*. 2003;38(2):79-82. doi:10.1159/000068048.

Morita M, Miyauchi A, Okuda S, et al. Comparison between MRI and myelography in lumbar spinal canal stenosis for the decision of levels of decompression surgery. *J Spinal Disord Tech.* 2011; 24(1):31-36.

Naganawa T, Miyamoto K, Ogura H, et al. Comparison of magnetic resonance imaging and computed tomogram-myelography for evaluation of cross sections of cervical spinal morphology. *Spine*. 2011; 36(1):50–56.

National Institute of Neurological Disorder and Stroke (NINDS). Tethered Spinal Cord Syndrome Information Page. http://www.ninds.nih.gov/disorders/tethered_cord/tethered_cord.htm. Published 2011.

North American Spine Society (NASS). Five Things Physicians and Patients Should Question. Choosing Wisely®. http://www.choosingwisely.org/societies/north-american-spine-society/. Published October 9, 2013.

North American Spine Society (NASS). Evidence-based Clinical Guidelines for Multidisciplinary Spine Care. Diagnosis and Treatment of Lumbar Disc Herniation with Radiculopathy. 2012.

https://www.spine.org/Portals/0/Assets/Downloads/ResearchClinicalCare/Guidelines/LumbarDiscHerniation.pdf

Ostergaard M, Lambert RG. Imaging in ankylosing spondylitis. *Ther Adv Musculoskelet Dis.* August 2012; 4(4):301-311. doi: 10.1177/1759720X11436240. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3403247/. Retrieved March 29, 2018.

Ozdoba C, Gralla J, Rieke A, et al. Myelography in the age of MRI: Why we do it, and how we do it. *Radiol Res Prac*. 2011; Article ID 329017.

Ozturk C, Karadereler S, Ornek I, Enercan M, Ganiyusufoglu K, Hamzaoglu A. The role of routine magnetic resonance imaging in the preoperative evaluation of adolescent idiopathic scoliosis. *Int Orthop*. 2010;34(4):543-546. doi:10.1007/s00264-009-0817-y.

Pirker W, Katzenschlager R. Gait disorders in adults and the elderly : A clinical guide. *Wien Klin Wochenschr*. 2017;129(3-4):81-95. doi:10.1007/s00508-016-1096-4.

Pomerantz SR. Myelography: modern technique and indications. *Handb Clin Neurol*. 2016; 135:193-208.

Radic JAE, Cochrane DD. Choosing wisely canada: pediatric neurosurgery recommendations. *Paediatr Child Health*. 2018;23(6):383-387. doi:10.1093/pch/pxy012.

Rao D, Scuderi G, Scuderi C, Grewal R, et al. The use of imaging in management of patients with low back pain. *J Clin Imaging Sci*. 2018 Aug 24; 8:30.

Rush JK, Astur N, Scott S, et al. Use of magnetic resonance imaging in the evaluation of spondylolysis. *J Pediatr Orthop*. 2015 Apr-May; 35(3):271-5.

Shah LM, Salzman KL. Imaging of spinal metastatic disease. *Int J Surg Oncol*. 2011; 2011:769753.

Sieper J, Rudwaleit M, Baraliakos X, et al. The assessment of SpondyloArthritis international Society (ASAS) handbook: a guide to assess spondyloarthritis. *Ann Rheum Dis*. June 2009; 68 Suppl 2:ii1-44. Retrieved March 29, 2018.

Starling A, Hernandez F, Hoxworth JM, et al. Sensitivity of MRI of the spine compared with CT myelography in orthostatic headache with CSF leak. *Neurology*. 2013;81(20):1789-1792. doi:10.1212/01.wnl.0000435555.13695.22.

Strahle J, Muraszko KM, Kapurch J, Bapuraj JR, Garton HJL, Maher CO. Chiari malformation Type I and syrinx in children undergoing magnetic resonance imaging. *J Neurosurg Pediatr*. 2011;8(2):205-213. doi:10.3171/2011.5.PEDS1121.

Strahle J, Smith BW, Martinez M, et al. The association between Chiari malformation Type I, spinal syrinx, and scoliosis. *J Neurosurg Pediatr*. June 2015; 15(6):607-611. Retrieved March 29, 2018.

Trenga AP, Singla A, Feger MA, et al. Patterns of congenital bony spinal deformity and associated neural anomalies on X-ray and magnetic resonance imaging. *J Child Orthop*. August 2016; 10(4):343-352. doi: 10.1007/s11832-016-0752-6. Retrieved March 29, 2018.

Willen J, Wessberg PJ, Danielsson B. Surgical results in hidden lumbar spinal stenosis detected by axial loaded computed tomography and magnetic resonance imaging: An outcome study. *Spine*. 2008; 33(4):E109-E115. doi: 10.1097/BRS.0b013e318163f9ab.

Ziu E, Viswanathan VK, Mesfin FB. Cancer, Spinal Metastasis. [Updated 2020 Mar 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: **https://www.ncbi.nlm.nih.gov/books/NBK441950/.**

Zywicke HA, Rozzelle CJ. Sacral dimples. *Pediatr Rev*. 2011;32(3):109-113; quiz 114, 151. doi:10.1542/pir.32-3-109.

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

Reviewed / Approved by [illegible]ee

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.