PROVIDER*ALERT*

AmeriHealth Caritas Louisiana

To: **AmeriHealth Caritas Louisiana Providers**

Date: **December 20, 2021**

Subject: **Updated Clinical Guidelines**

Summary: Updated Clinical Guidelines for Magellan/National Imaging Associates

AmeriHealth Caritas Louisiana would like to make you aware of the updated Magellan/National Imaging Associates clinical guidelines that have been approved by the Louisiana Department of Health in accordance with La. R.S. 46:460.54 and will become effective **January, 20, 2022**. The new guidelines can be found at the following link: https://www1.radmd.com/all-health-plans/amerihealth-caritas-louisiana.aspx [radmd.com]

Questions: Thank you for your continued support and commitment to the care of our members. If you have questions about this communication, please contact AmeriHealth Caritas Louisiana Provider Services at 1-888-922-0007 or your Provider Network Management Account Executive.

Missed an alert?
You can find a complete listing of provider alerts on the Provider Newsletters and Updates page of our website.

Where can I find more information on COVID-19?
AmeriHealth Caritas Louisiana has updated its website to streamline communications and important notifications about COVID-19. Please visit http://amerihealthcaritasla.com/covid-19 for up-to-date information for both providers and members, including frequently asked questions, and important provider alerts from AmeriHealth Caritas Louisiana and the Louisiana Department of Health.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **BREAST MRI**	**Original Date: September 1997**
CPT Codes: **Unilateral without contrast 77046** **Bilateral without contrast 77047** **Unilateral without and with contrast 77048** **Bilateral without and with contrast 77049, +0698T**	**Last Revised Date: July 2021**
Guideline Number: NIA_CG_023	**Implementation Date: January 2022**

INDICATIONS FOR BREAST MRI

(Please see boxed statements below for specific requirements for the following: Commonwealth of Pennsylvania; State of Connecticut; State of North Carolina)

NO HISTORY OF KNOWN BREAST CANCER

For screening examination to detect breast cancer in any of the following situations

- A Breast Cancer Risk Assessment (**including** the Breast Cancer Consortium Risk Model (BCSC) which incorporates breast density, the International Breast Cancer Intervention Study **(IBIS)/ Tyrer-Cuzick** model, the Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm model (BOADICEA), the modified Gail (NCCN, **2021**) (also known as **the** Breast Cancer Risk assessment tool (BCRAT)) or other validated risk assessment models) that identifies the patient as having a lifetime risk of 20% or greater of developing breast cancer
    - Approve annually beginning 10 years prior to youngest family member's age at diagnosis **or at age 40, whichever comes first**, but not before age **25** (ACR, 2018; ASBrS, 2017; Levitan, 2019; Marino, 2018; NCCN, 20**21**)
- **Patients with lifetime risk of 20% or greater of developing breast cancer based on history of lobular neoplasia (LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia)) or ADH (atypical ductal hyperplasia)**
    - **Approve annually beginning at age of diagnosis of LCIS/ALH or ADH but not prior to age 25 (NCCN, 2021**)
- Patients with history of extensive chest irradiation (usually as treatment for Hodgkin's or other lymphoma between ages ten and thirty)
    - Begin **eigh**t years after radiation, but not prior to age 25 (NCCN, 20**21**)

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

- Patients with known *BRCA 1/2* mutation
    - Approve annually starting at age 25 (ASBrS, 2017; NCCN, 20**21**)
- Patients not yet tested for *BRCA* gene, but with known *BRCA* mutation in first-degree relative
    - Approve annually starting at age 25 (ASBrS, 2017; NCCN, 20**21**)
- Personal history of germline mutations known to predispose to a high risk of breast cancer (NCCN, 20**21**):
    - Li-Fraumeni syndrome (*TP53* mutation)
        - Begin age 20-29 or age at earliest diagnosed breast cancer in family
    - Cowden syndrome (*PTEN*) or Bannayan-Riley-Ruvalcaba syndrome (BRRS)
        - Begin 30-35 or 5-10 **years** before earliest breast cancer **diagnosis** in family
    - *ATM*
        - Begin age 40
    - ***BARD1***
        - **Begin age 40**
    - *CDH1*
        - Begin age 30
    - *CHEK2*
        - Begin age 40
    - *NF1*
        - Begin age 30
    - *PALB2*
        - Begin age 30
    - Peutz-Jeghers Syndrome (*STK11*)
        Begin age 25

For evaluation of identified lesion, mass, or abnormality in breast in any of the following situations

- Evaluation of suspected breast cancer when other imaging examinations, such as ultrasound and mammography, and physical examination are inconclusive for the presence of breast cancer, and biopsy could not be performed (e.g., seen only in single view mammogram without ultrasound correlation)
    - Includes skin changes of suspected inflammatory breast cancer if conventional imaging and skin biopsies are first performed and negative (ASBrS, 2017; Geiss, 2017; Yad**av** 2018)
- Inconclusive or conflicting findings on a **diagnostic** mammogram or ultrasound when the finding is not a palpable or a discrete mass
- **For evaluation of suspicious mass, lesion, distortion, or abnormality of the breast in patient with history of breast cancer when other imaging is inconclusive**
- For cases of new nipple inversion when mammographic and sonographic findings are inconclusive and a biopsy cannot be performed (Killelea, 2019)
- Patients diagnosed with biopsy-proven lobular neoplasia, i.e., **LCIS/**ALH (**Lobular Carcinoma in Situ** /Atypical Lobular Hyperplasia) or **ADH (atypical ductal hyperplasia**) (ASBrS, 2017; Monticciolo, 2017; NCCN, 2021)
- Spontaneous unilateral serous or bloody nipple discharge when conventional imaging is normal and there is no palpable mass (ASBrS, 2017; Bahl, 2015; NCCN, 20**21**)

- Paget's disease of the nipple: to detect underlying ductal carcinoma when conventional imaging is normal and there is no palpable mass (ASBrS, 2017)
- For a phylloides tumor diagnosed by biopsy, breast MRI may help determine extent of disease and resectability in selected cases. However routine use for surgical planning is controversial (Grau, 2019)
- Follow-up of a probably benign (BI-RADS 3) lesion seen only on prior MRI (when prior mammogram and ultrasound did not show the abnormality) (Lee, 2018; Panigrahi, 2019; Spick, 2018)

HISTORY OF KNOWN BREAST CANCER

- Yearly surveillance for history of breast cancer and dense breast tissue on mammography (ACR, 2018)
- Yearly surveillance for individuals with personal history of breast cancer diagnosed before age 50 (ACR, 2018)
- **Yearly surveillance in patients with genetic or other risk factors placing them at high risk for a new cancer or recurrence (ASBrS, 2017; Park, 2018)**

Staging, treatment, and surveillance of patients with a known history of Breast Cancer

- Approve **for** initial staging when conventional imaging is indeterminate **in defining the extent of cancer, or presence of** multifocal, multicentric, **or** contralateral cancer, or **if** there is a discrepancy in estimated tumor size between physical exam and imaging (ASBrS, 2017; NCCN, 20**21**)
- For invasive lobular carcinoma that is poorly **or inadequately** defined by mammography, ultrasound, **or** physical exam (NCCN, 20**21**)
- **To identify primary cancer in a patient with axillary nodal adenocarcinoma and unidentified primary tumor (NCCN, 2021)**
- **Prior to treatment: To serve as a baseline for comparison prior to a patient starting planned neoadjuvant chemotherapy (ACR, 2017)**
- During or after treatment: To identify candidates for breast conserving therapy or evaluate response to treatment, including preoperative neoadjuvant therapy [within three (3) months] (ASBrS, 2017)

Silicone Implants

MRI is not indicated for evaluation of saline implant complications or for asymptomatic silicone implants.
(ACR, 2018; L**o**urenc**o**, 2018)

- Confirmation of suspected silicone gel-filled breast implant ruptures in a*symptomatic* patients, after an abnormal or indeterminate finding on mammography or breast ultrasound
- MRI is considered the gold standard for evaluation of symptomatic silicone implant rupture (ACR, 2018; ASbrS, 2017). **Prior imaging is not required in patients with silicone implants and symptoms of possible rupture.**
- For postoperative evaluation of silicone breast implant complications when other imaging is inconclusive

Pre-operative

- For preoperative evaluation for known breast cancer when surgery planned within thirty (30) days to be determined on a case-by-case basis (ASBrS, 2017; NCCN, 2019; Susnik, 2018; Wong, 2018)

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (ACR, 2018)

*****FOR STATE OF CONNECTICUT ONLY*****
CT ST § 38a-530
Effective: October 1, 2020

Coverage for breast MRI is mandated within the State of Connecticut without coinsurance, copay of more than $20 deductible, or other out of pocket expenses for women with dense breast tissue if the woman is believed to be at increased risk of breast cancer because of family or personal history of breast cancer, positive genetic testing. Coverage is also mandated for other indications determined by a woman's physician, or when screening is recommended by a physician and the woman is over age 40, has a family or prior history of breast cancer or has breast disease diagnosed through biopsy as benign. This applies to high deductible plans unless plans are used to establish an HRA or HSA to the extent permitted by federal law. Though not designated in the original intent of the bill, language includes the above provisions and criteria for breast MRI.

Source: Connecticut General Assembly
https://www.cga.ct.gov/current/pub/chap_700c.htm

*****FOR STATE OF NORTH CAROLINA ONLY*****

Medicaid and NCHC cover magnetic resonance imaging (MRI) for the detection of:

1. Breast cancer in beneficiaries who are at a high genetic risk for breast cancer:
    A. known BRCA 1 or 2 mutation in beneficiary;
    B. known BRCA 1 or 2 mutation in relatives; or
    C. pattern of breast cancer history in multiple first-degree relatives, often at a young age and bilaterally.
2. Breast cancer in beneficiaries who have breast characteristics limiting the sensitivity of mammography (such as dense breasts, implants, scarring after treatment for breast cancer).
3. A suspected occult breast primary tumor in beneficiaries with axillary nodal adenocarcinoma with negative mammography and clinical breast exam.
4. Breast cancer in beneficiaries with a new diagnosis of breast cancer. It can be used to determine the extent of the known cancer and/or to detect disease in the contralateral breast.
5. To evaluate implant integrity in beneficiaries with breast implants.

Source: NC Medicaid, Amended March 15, 2019
https://files.nc.gov/ncdma/documents/files/1K-1_2.pdf

*****FOR THE COMMONWEALTH OF PENNSYLVANIA ONLY*****
40 P.S. § 764c
Act of Jul. 1, 2020, P.L. 572, No. 52 (SB 595)

I. Plans that provide hospital or medical/surgical coverage shall also provide coverage for breast imaging.
II. The minimum coverage required shall include:
    1. Supplemental magnetic resonance imaging or, if such imaging is not possible, ultrasound
    2. If recommended by the treating physician because the woman is believed to be at an increased risk of breast cancer due to:
        a. personal history of atypical breast histologies;
        b. personal history or family history of breast cancer;
        c. genetic predisposition for breast cancer;
        d. prior therapeutic thoracic radiation therapy;
        e. heterogeneously dense breast tissue based on breast composition categories of the Breast Imaging and Reporting Data System established by the American College of Radiology with any one of the following risk factors:
            i. lifetime risk of breast cancer of greater than 20%, according to risk assessment tools based on family history;
            ii. personal history of BRCA1 or BRCA2 gene mutations;
            iii. first-degree relative with a BRCA1 or BRCA2 gene mutation but not having had genetic testing herself;
            iv. prior therapeutic thoracic radiation therapy between 10 and 30 years of age; or
            v. personal history of Li-Fraumeni syndrome, Cowden syndrome or Bannayan-Riley-Ruvalcaba syndrome or a first-degree relative with one of these syndromes;
            vi. extremely dense breast tissue based on breast composition categories of the Breast Imaging and Reporting Data System established by the American College of Radiology.

Nothing in this subsection shall be construed to require an insurer to cover the surgical procedure known as mastectomy or to prevent the application of deductible, copayment or coinsurance provisions contained in the policy or plan.

Source: Senate Bill 595 @
https://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2020&sessInd=0&act=52

BACKGROUND

Magnetic resonance imaging (MRI) of the breast is a useful tool for the detection and characterization of breast disease, assessment of local extent of disease, evaluation of treatment response, and guidance for biopsy and localization (Panourgias, 2018). Breast MRI should **always** be bilateral **to allow for assessment of symmetry between the breasts**. MRI findings should be correlated with clinical history, physical examination, and the results of mammography and any other prior breast imaging.

OVERVIEW

Staging of newly diagnosed breast cancer – The decision to use breast MRI as an adjunct to clinical exam, mammography, and ultrasound should be made by the physician on a case-by-case basis, taking into account frequent false positives, increased time to treatment, and increased mastectomy rates. "There is no convincing evidence that MRI reduces re-excision Lumpectomy rates, local recurrence, or overall survival in patients with invasive breast cancer or ductal carcinoma in situ" (ASBrS, 2017; NCCN, 20**21**).

MRI and risk evaluation – **The age of a family member's diagnosis is only relevant for patients under the age of 40. Anyone 40 or over should be getting annual mammograms and breast MRIs if their lifetime risk is 20% or greater.**

MRI and dense breasts – Women with extremely dense breasts are 4-6x more likely to develop breast cancer than women with fatty tissue. Between 40 - 50% of US women aged 40-74 years have dense breast tissue. Breast density decreases the sensitivity of mammography and is associated with aggressive tumors and worse outcomes. There are four categories for breast density- almost entirely fatty, scattered areas of fibroglandular tissue, heterogeneously dense, and extremely dense. The last two are considered dense. Women with dense breasts and a BCSC risk of ≥ 2.5% (about 21%) are at greatest risk for interval stage IIb or higher cancers. Thus, knowing a women's risk along with density identifies subgroups who will benefit most from supplemental testing, such as ultrasound or MRI. Without considering overall breast cancer risk, MRI could result in more harm than good in terms of anxiety, overdiagnosis, and increased benign breast biopsies. (**Kerlikowski**, 2019). For women whose only risk is increased breast density, ultrasound can be considered for adjunctive screening (Monticciolo, 2018).

A movement to notify women of their breast density is now expanded, as of April 2019, to 38 states and the District of Columbia. Although there has been an increase in notification and awareness of breast density, no clear guidelines have been established for supplemental screening in this subset of women. A recent study showed that the majority of practices are utilizing supplemental screening, but the modalities used and referral patterns vary depending on several factors including location, type of practice (i.e., private or academic), and whether the practice has breast specialists. Also, the exact notification requirements as well as insurance coverage vary from state to state. Screening ultrasound was most utilized (53%) and most available in the Northeast (80%). Connecticut, for example, requires insurance to cover supplemental ultrasound exams. In this study 19.5% had MRI for supplemental screening and 87% of these were private practice settings (Choudhery, 2020). At the present time, except in states that require it, more research is needed before approval of MRI for supplemental screening based on breast density alone, without other risk factors (Bakker, 2019; Destounis, 2020; **Kerlikowski**, 2019).

MRI and breast cancer risk associated with certain syndromes

- Lynch Syndrome- Women with Lynch syndrome and mismatch repair genes *MLH1* and *MSH2* may be at increased risk for breast cancer; however, breast screening is not recommended beyond what is recommended for an average risk patient (NCCN, 20**21**).

- NF-1- Mammography starting at age 30; breast MRI may be considered.

There is currently **limited** evidence that *RAD51C* and *RAD51D* genes are associated with increased risk of breast cancer. Insufficient evidence for *FANCC*, *MRE11A*, or *MUTYH* heterozygotes, or *RECQL4, RAD50, RINT1, SLX4, SMARCA4*, or *XRCC2*. For *STK11* (associated with Peutz-Jeghers syndrome) breast cancer risk is 8% at age 40, 13% age 50, 31% at age 60, **and** 45% age 70.

Surgical excision vs MRI – Select patients may be suitable for monitoring in lieu of excision (although MRI is not indicated); e.g., Flat epithelial hyperplasia, papillomas without atypia, fibroepithelial lesions favoring fibroadenoma, radial scars adequately sampled or incidental. Other pathologies that may require excision include mucin-producing lesions, potential phylloides tumor, papillary lesions, radial scar, or other histologies of concern to the pathologist (NCCN, 20**21**).

MRI during or after neoadjuvant chemotherapy – Dynamic contrast-enhanced MRI may be used to monitor response of a tumor to neoadjuvant chemotherapy used to shrink the tumor before surgery. This is very important in clinical decision making as alternative therapies may be selected based upon the **MRI** results. It may also be used to depict residual disease after neoadjuvant chemotherapy. MRI-compatible localization tissue markers should be placed prior to neoadjuvant chemotherapy to evaluate the location of the tumor in the event of complete response (ACR, 2018).

MRI and breast implants – For asymptomatic women with silicone implants, no imaging is recommended for evaluation. However, MRI may be used in asymptomatic patients with silicone breast implants to evaluate breast implant integrity when a mammogram and/or ultrasound is suspicious for implant rupture.

For evaluation of unexplained axillary adenopathy in a patient under age 30, ultrasound (US) of the axilla is the recommended initial test. For age over 30, a mammogram and/or US of the axilla are recommended.

MRI after mastectomy – Most breast tissue is removed after mastectomy; however, recurrence may occur in residual tissue. The majority occur in the skin, subcutaneous tissues or deep to the pectoralis muscle and are reported to be about 1-2% annually. Clinical evaluation is the mainstay of the **post**-mastectomy breast. For a palpable lump or pain on the side of mastectomy with or without reconstruction or a high-risk patient **post**-bilateral prophylactic mastectomy with reconstructions, MRI is not indicated. There is no relevant literature to support MRI to screen the **post**-mastectomy breast (although may be indicated for contralateral native breast based on breast cancer risk). MRI may be useful for a palpable lump to help characterize malignancy once identified by ultrasound. Note that tissue expanders may be a contraindication to MRI (ACR, 2020).

Breast pain – Breast pain is a common complaint with the incidence of breast cancer with breast pain as the only symptom, 0-3%. Clinically insignificant breast pain is cyclical, non-focal, or diffuse. There is no relevant literature regarding the use of MRI for focal or non-cyclical breast pain at any age (ACR, 2018).

MRI for a mass – "Any highly suspicious breast mass detected by imaging should be biopsied, irrespective of palpable findings; and any suspicious breast mass detected by palpation should be biopsied, irrespective of imaging findings" (ACR, 2016).

MRI and known breast cancer – "The ASBrS does not recommend routine diagnostic MRI in newly diagnosed breast cancer patients except as part of a scientific study… Routine annual MRI is not indicated for screening of women with a prior history of breast cancer unless they have a known genetic or other significant risk factor placing them at high-risk for a new breast cancer …" (ASBrS, 2017). Clinical indications and applications per NCCN state that Breast MRI may be used for staging evaluation to define extent of cancer or presence of multifocal or multicentric disease in the ipsilateral breast, or as screening of the contralateral breast at time of initial diagnosis (Category 2B); however, there are no high level data to demonstrate that the use of MRI to facilitate local therapy decision-making improves local recurrence or survival. False positive findings are common and surgical decisions should not be based solely on MRI, tissue sampling of areas of concern recommended (NCCN, **2021**).

MRI and breast cancer in men – Breast MRI is generally not indicated for palpable masses or axillary adenopathy prior to biopsy. Studies are limited as to the diagnostic accuracy or clinical usefulness of MRI in male patients (ACR, 2018).

Nipple discharge – Nipple discharge is a common complaint with at least 80% of women having at least 1 episode. Discharge that is considered pathologic is unilateral, spontaneous, from one duct orifice and serous or bloody. Physiologic discharge will be bilateral, from multiple ducts, and white, green, or yellow in color. "In general, MRI should be considered in cases in which other approaches have failed to identify an underlying cause of pathologic nipple discharge. The sensitivities of breast MRI for detection of underlying cause of pathologic nipple discharge are 86% to 100% for invasive cancer and 40% to 100% for noninvasive disease" (ACR, 2016). Ductography (galactography) has the ability to demonstrate very small lesions in the specific duct that is secreting the pathologic nipple discharge. However, it is invasive and may cause discomfort and pain. It can be time-consuming and technically challenging and the rate of incomplete ductography is as high as 15%. The discharge must be present on the day of the study so that a cannula can be placed in the appropriate duct. Failure to cannulate the discharging duct may occur and cannulation of the wrong duct may cause a false-negative ductogram (ACR, 2016).

BI-RADS 3 (Probably Benign) MRI and Follow-up – A follow-up MRI study may be indicated to confirm stability of a probably benign mass seen only on prior MRI. In a review of sixteen studies of high-risk patients, the frequency of MRI examinations reported as BI-RADS 3 was between 6 and 12% (Lee, 2018). In an average risk screening population of 2120 women and 3,861 MRI exams, 4.9% of MRI exams were BI-RADS 3 (Kuhl, 2017). Specific features of what constitutes a BI-RADS 3 lesion were not described in these studies, is at the discretion of the reporting radiologist, and still **had an** evolving **definition** during the study periods. At this writing the appropriate use of BI-RADS 3 for breast MRI has not been fully defined (Panigrahi, 2019). "The most appropriate and common use of BI-RADS 3 assessment is for a round- or oval-shaped mass with circumscribed margins and hyperintense T2 signal, which has either homogeneous enhancement or dark internal septations on a baseline examination. A

mass meeting these criteria is most likely an intramammary lymph node or fibroadenoma" (Lee, 2018). The reported malignancy rate is ≤ 2% for lesions classified as BI-RADS 3 (Lee, 2018; Spick, 2018).

POLICY HISTORY

Date	Summary
July 2021	• Improved section on when to begin high risk screening for patients with lifetime risk of 20% or greater. • Added section on high risk screening in patients with lifetime risk of 20% or greater based on history of LCIS/ALH/ADH. • Changed high risk screening start date to 8 years after chest irradiation per NCCN • Added BARD1 germline mutation • Improved section on when MRI may be indicated for a new diagnosis of breast cancer • Added indication of baseline MRI prior to starting neoadjuvant chemotherapy • Improvement background section on MRI of the breast • Updated background section on genetic syndromes • Removed background section on abbreviated breast MRI
February 2021	• **Added state specific language box for State of Pennsylvania** • **Added citations to state specific boxes**
May 2020	• **Added not indicated for saline implants, or asymptomatic silicone without prior imaging** • **Added gold standard for symptomatic silicone implant rupture** • **Removed section on increased breast density** • **Improved section on breast assessment tools** • **Improved section on germline mutations from NCCN 2019** • **Added indication of new nipple inversion** • **Added phylloides** • **Added ACR for known breast cancer surveillance with dense tissue or dx < age 50** • **Added comment section on MR for dense breast, syndromes, implants, after mastectomy, breast pain, cancer in male**
September 2019	• **Added state specific language boxes for State of Connecticut and State of North Carolina**
April 2019	• **For silicone implants indication, added qualifying terms to assure patient is symptomatic and other imaging is inconclusive** • **For 'No history of breast cancer, screening examinations' added specifics about when the screening should be done**

	• **Removed indication "Two or more first degree relatives (parents, siblings, and children) have history of breast cancer"** • **Provided specifics on chest radiation including when to start screening: "Patients with histories of extensive chest irradiation (usually as treatment for Hodgkin's or other lymphoma between ages ten and thirty. Begin ten years after radiation, but not prior to age 25"** • **For indication: "Personal history of germline mutations", removed 'or first degree relative with' and added some of the different mutations and when screening should begin** • **For indication: "For evaluation of identified lesion, mass, or abnormality in breast in any of the following situations", removed "Two or more first degree relatives with history of breast cancer"** • **For "Evaluation of breast cancer when other imaging exams are inconclusive" added "includes skin changes of suspected inflammatory breast cancer"** • **Expanded the suspicious precursor lesions to include "atypical lobular hyperplasia and lobular carcinoma in situ"** • **Added indications: "Spontaneous unilateral serous or bloody nipple discharge when conventional imaging is normal and there is no palpable mass" AND "Paget's disease of the nipple: to detect underlying ductal carcinoma when conventional imaging is normal and there is no palpable mass"** • **Added indication: "Follow-up of a BI-RAD 3 lesion seen only on prior MRI when prior mammogram and US did not show the abnormality"** • **History of Known Breast Cancer: Changed subheading from "Screening exam to detect breast cancer" to "Staging, treatment, and surveillance of patients with a known history of breast cancer" AND added specific indications including:** o **Approve initial staging when conventional imaging is indeterminate in defining multifocal, multicentric, contralateral cancer or there is a discrepancy in estimated tumor size between physical exam and imaging** o **During or after treatment to identify candidates for breast conserving therapy or evaluate response to treatment, including preoperative neoadjuvant therapy [within three (3) months]** o **Yearly surveillance in patients with genetic or other risk factors placing them at high risk for a new cancer or recurrence"**

	• **For evaluation of suspicious mass, lesion, distortion, or abnormality of breast in patient with history of breast cancer: added - 'when other imaging is inconclusive'** • **Added Background information on Nipple Discharge and specifics on screening for newly diagnosed or patients with breast cancer history** • **Updated references**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **BRAIN (HEAD) MRS**	**Original Date: April 2007**
CPT Codes: 76390, +0698T	**Last Revised Date: February 2021**
Guideline Number: NIA_CG_003	**Implementation Date: January 2022**

INDICATIONS FOR BRAIN MRS
(ACR, 2019)

- For the evaluation of a recurrent or residual brain tumor from post-treatment changes, e.g., radiation necrosis (Chuang, 2016)
- For further evaluation **of** a brain lesion to distinguish a brain tumor from other non-tumor diagnoses (e.g., abscess or other infectious or inflammatory process) (Alam, 2011; Majós, 2009)

BACKGROUND
(Alam, 2011; Hellström, 2018)

Magnetic resonance spectroscopy (MRS) is a noninvasive imaging technique that determines the concentration of brain metabolites, such as N-acetylaspartate, choline, creatine, and lactate, within the body tissue examined. Radiofrequency waves are translated into biochemical composition of the scanned tissue; the resulting metabolic profile is useful in identifying brain tumors, e.g., differentiating neoplastic and non-neoplastic brain lesions. In selected cases, MRS may be a valuable supplement to MRI. It is sensitive, but nonspecific. This modality should be considered as an adjunct to conventional imaging rather than replacement for histopathological evaluation.

In terms **of** brain tumor **evaluation and classification**, carefully designed multi-center trials complying with criteria of evidence-based medicine have not yet been completed (Horská, 2010).

Tumor Recurrence vs. Radiation Necrosis – Differentiation between recurrent brain tumors and treatment related injury, e.g., radiation necrosis, is difficult using conventional MRI. The typical appearance of radiation necrosis is similar to that of recurrent brain tumors. MRS is a quantitative approach, measuring various brain metabolic markers, to help in the differentiation of recurrent tumors and radiation necrosis. This differentiation is important as additional radiation can benefit

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recurrent disease but can be detrimental to radiation necrosis. MRS may help in determining treatment options and in preventing unnecessary surgery. In addition, a tumor recurrence diagnosed by MRS allows the surgeon to begin treatment early instead of having to wait for symptoms of recurrence or biopsy confirmation (Barajas, 2009; Chuang, 2016; Smith, 2009). However, no consensus exists regarding the value of this in clinical decision making, and no approach has yet been validated to be sufficiently accurate (Chuang, 2016; Sundgren, 2009; Walker, 2014).

Glioma – MRS has been proposed for pre-operative grading of gliomas and differentiating high-grade gliomas (HGGs) from low-grade gliomas. It has been found to have moderate diagnostic value and should be combined with other advanced imaging techniques to improve accuracy. Currently, the data is limited; more research is need**ed** for a definite conclusion for the utility of MRS for this indication. Therefore, it remains experimental/investigational (Abrigo, 2018; Wang, 2016).

MRS in other diseases - A role for MRS has been suggested in the management of neurodegenerative disease, epilepsy, and stroke. However, to better define this role, it will be necessary to standardize the MRS methodology, as well as the collection, analysis, and interpretation of data so it can be consistently translated to the applicable clinical settings. Currently, these potential applications remain experimental/investigational (Oz, 2014).

POLICY HISTORY

Date	**Summary**
February 2021	**Updated background information and references**
May 2020	**Updated references**
July 2019	• **Deleted therapeutic f/u indication** • **Added tumor versus non tumor indication** • **Updated background info and refs**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **BRAIN (HEAD) MRI** **BRAIN (HEAD) MRI with IAC (Internal Auditory Canal)**	**Original Date: September 1997**
CPT Codes: **70551, 70552, 70553, +0698T – Brain MRI** **70540, 70542, 70543, +0698T - IAC**	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_001	**Implementation Date: January 2022**

INDICATIONS FOR BRAIN MRI

Brain MR/MRA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain MR/Brain MRA combination studies section.

For evaluation of headache

(ACR, 2019c; Holle, 2013; Quinones-Hinojosa, 2003; Schafer, 2007; Wilbrink, 2009)

- Chronic headache with a change in character/pattern (e.g., more frequent, increased severity, or duration)
- Cluster headaches **or other trigeminal-autonomic cephalgias, i.e., paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks (SUNCT/SUNA**) imaging is indicated once to eliminate secondary **causes (IHS, 2018**)
- New acute headache, sudden onset:
    - With a personal or family history (brother, sister, parent, or child) of brain aneurysm or AVM (arteriovenous malformation) OR
    - < 48 hours of "worst headache in my life" or "thunderclap" headache.
        - Note: The duration of a thunderclap type headache lasts more than 5 minutes. Sudden onset new headache reaching maximum intensity within 2-3 minutes.
    - Prior history of stroke or intracranial bleed
    - Known coagulopathy or on anticoagulation
- New onset of headache with any of the following (ACR, 2019c; Micieli, 2020; Mitsikostas, 2016):
    - Acute, new, or fluctuating neurologic deficits, such as sensory deficits, limb weakness, speech difficulties, visual loss*, lack of coordination, or mental status changes or with signs of increased intracranial pressure (papilledema)

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* **Not explained by underlying ocular diagnosis, glaucoma, or macular degeneration**
    - History of cancer or significantly immunocompromised
    - Fever
    - Subacute head trauma
    - Pregnancy or puerperium (Hamilton, 2020; Shobeiri, 2019)
    - Age ≥ 50
    - Severe unilateral headache with radiation to or from the neck, associated with suspicion of carotid or vertebral artery dissection
    - Related to activity or event (sexual activity, exertion, position) (new or progressively worsening)
    - Persistent or progressively worsening during a course of physician-directed treatment (ACR, 2019c; Kuruvilla, 2015; Martin, 2011)

    Note: **Neuroimaging warranted for atypical/complex migraine aura, but not for a typical migraine aura (see background)**
- Special considerations in the pediatric population with persistent headache (Trofimova, 2018):
    - Occipital location
    - Age < 6 years
    - Symptoms indicative of **increased** intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting
    - Documented absence of family history of headache
    - Severe headache in a child with an underlying disease that predisposes to intracranial pathology (e.g., immune deficiency, sickle cell disease, neurofibromatosis, history of neoplasm, coagulopathy, hypertension, congenital heart disease)

For evaluation of neurologic symptoms or deficits
(ACR, **2012a**)

- Acute, new, or fluctuating neurologic symptoms or deficits such as, sensory deficits, limb weakness, speech difficulties, visual loss*, lack of coordination, or mental status changes
  * Not explained by underlying ocular diagnosis, glaucoma, or macular degeneration

For evaluation of known or suspected stroke or vascular disease
(ACR **2012a**, 2017**a**, 2019; Jauch, 2013)

- Known or suspected stroke with any acute, new, or fluctuating symptoms or deficits such as sensory deficits, limb weakness, speech difficulties, visual loss*, lack of coordination, or mental status changes
  *Not explained by underlying ocular diagnosis, glaucoma, or macular degeneration
- Suspected stroke with a personal or **first-degree** family history (brother, sister, parent, or child) of aneurysm or known coagulopathy or on anticoagulation
- Symptoms of transient ischemic attack (TIA) (**episodic neurologic symptoms such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes)**
- Evaluation of suspected acute subarachnoid hemorrhage (SAH)
- Follow-up for known hemorrhage, hematoma, or vascular abnormalities

Note: **MRI is the study of choice for detecting cavernous malformations (CCM). Follow-up imaging of known CCM should be done only to guide treatment decisions or to investigate new symptoms. First-degree relatives of patients with more than one family member with a CCM should have a screening MRI as well as genetic counseling (Akers, 2017; Velz, 2018; Zyck, 2021**)

- Suspected central venous thrombosis - see **background** (ACR, 2017**a**, Bushnell, 2014)
- Evaluation of neurological signs or symptoms in sickle cell disease (Mackin, 2014; Thust, 2014)

For evaluation of known or suspected trauma
(ACR, 2019**f**, Jagoda, 2008; Polinder, 2018)

- Known or suspected trauma or injury to the head with documentation of one or more of the following acute, new, or fluctuating:
    - Focal neurologic findings
    - Motor changes
    - Mental status changes
    - Amnesia
    - Vomiting
    - Seizures
    - Headache
    - Signs of increased intracranial pressure
- Known coagulopathy or on anticoagulation
- Known or suspected skull fracture by physical exam and/**or prior imaging**
- Post concussive syndrome if persistent or disabling symptoms and imaging has not been performed
- Subacute or chronic traumatic brain injury with new cognitive and/or neurologic deficit

For evaluation of suspected brain tumor, mass, or metastasis
(Kerjnick, 2008; NCCN, 20**20**)

- Suspected brain tumor with any acute, new, or fluctuating neurologic symptoms or deficits such as sensory deficits, limb weakness, speech difficulties, visual loss*, lack of coordination, or mental status changes
  * Not explained by underlying ocular diagnosis, glaucoma, or macular degeneration
- Suspected brain metastasis or intracranial involvement in patients with a history of cancer based on neurological symptoms or examination findings (may include new or changing lymph nodes)
- **Langerhans cell histiocytosis with visual, neurological, or endocrine abnormality; polyuria or polydipsia; suspected craniofacial bone lesions, aural discharge, or suspected hearing impairment/mastoid involvement (Haupt, 2013; NCCN, 2020**)

Suspected Pituitary Tumors
(ACR, 2018; GHRS, 2000; Kannan, 2013; Majumdar, 2013~~)~~

- With the following:
    - Neurologic findings (e.g., visual field deficit suggesting compression of the optic chiasm, **diplopia, gaze palsy**)

- Suspected hypofunctioning pituitary gland based on hormonal testing, e.g., hypopituitarism, growth hormone deficiency, hypogonadotropic hypogonadism [i.e., low gonadotropins (FSH/LH) and sex hormones*]
  * Severe secondary hypogonadism with total testosterone persistently < 150 and low or normal LH/FSH OR
  * Testosterone levels below normal range with low or normal LH/FSH; **AND**
    - Neurological sign**s and** symptoms; OR
    - Other pituitary hormonal abnormalities; OR
    - Consideration of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, or comorbid illness)
- Suspected hyperfunctioning pituitary gland based on hormonal testing, i.e., central hyperthyroidism (high TSH), Cushing disease (high ACTH), acromegaly/gigantism (high GH/IGF-1) or elevated prolactin (≥ 250 ng/mL or persistently elevated in the absence of another cause, e.g., stress, pregnancy, hypothyroidism, medication)
- Central Diabetes Insipidus (low ADH)
- Precocious puberty in a child (male < 9; female < 8), with hormonal studies suggesting a central cause and evidence of an accelerated bone age on x-ray (Faizah, 2012)
- Pituitary apoplexy with sudden onset of neurological and hormonal symptoms

For evaluation of known brain tumor, mass, or metastasis

- Follow-up of known malignant brain tumor
- Suspected recurrence with prior history of CNS cancer based on neurological symptoms or examination findings
- Patient with history of CNS cancer (either primary or secondary) and a recent course of chemotherapy, radiation therapy (to the brain), or surgical treatment within the last two (2) years (NCCN, 2020)
- Follow-up of known non-malignant brain tumor/lesion if symptomatic, new/changing signs or symptoms or complicating factors
- Follow-up of known meningioma (NHS, 2018)
  - If <2cm or heavily calcified at 2 years and 5 years
  - > 2cm annually for 3 years and then scans at 5 years and 10 years
  - Multiple meningiomas, annually
  - After treatment (surgery or radiotherapy), post-operative if concern for residual tumor, every 6-12 months, then annually for 3-5 years based on WHO Grade (see **background**)
- Follow-up **of** known pituitary adenoma
  - New **neuroendocrine** signs or symptoms
  - Functioning adenoma - to assess response to treatment and 1-year follow-up after drug holiday (Stoller, 201**5**)
  - Asymptomatic Macroadenoma (≥ 10mm) follow-up every 6-18 months, post-surgical **follow**-up 1-2 years after surgery (Dekkers, 2008)
  - Asymptomatic, non-functioning Microadenoma < 10mm repeat in one year; if stable, repeat every 2-3 years (Lake, 2013)
- Follow-**up** of known pineal cyst (≥ 5mm) if there are atypical features or symptoms (e.g., headaches, gaze paresis, ataxia, papilledema, nausea/vomiting) (Cauley, 2009; Jussila 2017)

- Follow-**up** of known arachnoid cyst (Al-Holou, 2010, 2013; Mustansir, 2018)
    - < 4 years old, serial imaging is warranted
    - > 4 years old, repeat imaging only if **newly** symptomatic, i.e., headaches, increased intracranial pressure, hydrocephalus, local mass effect, seizures, visual/endocrine dysfunction
- Tumor evaluation and monitoring in neurocutaneous syndromes – see background
- **Langerhans cell histiocytosis (Haupt, 2013, NCCN, 2020)**
    - **To assess treatment response and surveillance of known brain lesions**

For screening for known Non-CNS Cancer - see background
(NCCN, 2020)
- Default screening for
    - Kidney cancer
    - Lung cancer
    - Merkel cell carcinoma
    - Mucosal melanoma of the head and neck, especially of the oral cavity
    - Poorly differential neuroendocrine cancer (Large or Small cell/Unknown primary of neuroendocrine origin)
- Screening with preconditions
    - AML……. Suspicion of leukemic meningitis
    - Cutaneous melanoma…….. Stage IIIC or higher
    - Testicular cancer-Seminoma……. High risk
    - Gestational Trophoblastic Neoplasia…….. Pulmonary metastasis
    - Bladder cancer…… High risk, i.e., small cell
- All other cancer if CNS symptoms present

For screening of Hereditary Cancer Syndromes
- Li Fraumeni syndrome- Annually (**Kumar**, 2018)
- Von Hippel Lindau – Every 2 years, starting at age of 8 years (Rednam, 2017)
- Tuberous Sclerosis – Every 1-3 years, until the age of 25 years (Kr**ue**ger, 2013)
- MEN1 – Every 3-5 years, starting at the age of 5 years (Brandi, 2001)
- NF-2- Brain IAC: Annually starting **at the** age of 10 years (Evans, 2017)
- Sturge Weber Syndrome: Once, after age 1 to rule out intracranial involvement; in patients <1 year, only if symptomatic (Comi, 2011)

Indications for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases
(NCCN, 202**0**)
- ≤ 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 seizure disorder
(ACR, 2019**d**; Cendes, 2016; Gaillard, 2009; Ho, 2013; Krumholz, 2007; Ramli, 2015)
- New onset of an unprovoked seizure in adults

- Newly identified change in seizure activity/pattern
- Known seizure disorder without previous imaging
- Medically refractory epilepsy
- Imaging indications for new onset seizures in the pediatric population (Hirtz, 2000; Kimia, 2012; Sadeq, 2016; **Shaikh**, 2019)
    - Abnormal neurological exam, especially a postictal focal deficit
    - Significant developmental delay
    - Focal onset
    - EEG shows focal or suspected structural abnormalities
    - <1 year of age

Note: Imaging is not indicated in simple febrile seizures

For evaluation of suspected multiple sclerosis (MS)
(CMSC, 2018; Thompson, 2017; Traboulsee, 2016)

- For evaluation of patient with neurologic symptoms or deficits suspicious for MS with
    - A clinically isolated syndrome (optic neuritis, transverse myelitis, or brain stem syndrome); **OR**
    - Recurrent episodes of variable neurological signs or symptoms not attributable to another cause
- To demonstrate dissemination in time for diagnosis (6-12 months for high risk, 12-24 months for low risk)

For evaluation of known multiple sclerosis (MS)
(CMSC, 2018)

- To establish a new baseline (no recent imaging, postpartum, or 6-12 months after switching disease modifying therapy)
- Prior to starting or switching disease-modifying therapy
- Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years
- New signs or symptoms suggested of an exacerbation or unexpected clinical worsening
- Progressive Multifocal Leukoencephalopathy (PML) surveillance for patients on natalizumab (**Tsyabri) (McGuigan, 2016)**
    - **12 months after the start of treatment in all patients**
    - **Further surveillance MRI scanning timing is based on anti-JCV antibody status**
        - **If anti-JCV antibody negative, annually**
        - **If anti-JCV antibody positive and antibody index < 1.5. every 6 months**
        - **If anti-JCV antibody positive and antibody index > 1.5, every 3-4 months**

For evaluation of known or suspected infectious or inflammatory disease (e.g., meningitis or abscess)
(Lummel, 2016; Oliveira, 2014)

- Suspected intracranial abscess or brain infection with acute altered mental status or with positive lab findings (such as elevated WBCs) OR follow-up assessment during or after treatment completed

- Meningitis with positive signs and symptoms (such as fever, headache, mental status changes, stiff neck) OR with positive lab findings (such as elevated white blood cells or abnormal lumbar puncture fluid exam)
- Suspected **e**ncephalitis with headache and altered mental status or follow-up as clinically warranted
- Endocarditis with suspected septic emboli
- Suspected temporal arteritis in a patient ≥ 50 with temporal headache, abrupt visual changes, jaw claudication, temporal artery tenderness, constitutional symptoms or elevated ESR (Diamantopoulos, 2014; **D'Souza, 2016**; Klink, 2014; Salehi, 2016; **Yip 2020**); **AND**
    - Negative initial work-up (color Doppler ultrasonography or biopsy); **OR**
    - Atypical features, failure to response to treatment or concern for **intracranial involvement**

  Note: Protocol should include high-resolution contrast-enhanced imaging the temporal artery
- **Central Nervous System (CNS) involvement in patients with known or suspected vasculitis or autoimmune disease with abnormal inflammatory markers or autoimmune antibodies**
- **Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up (Godasi, 2019; Zuccoli, 2011**)
- Immunocompromised patient (e.g., transplant recipients, HIV with CD4<200, primary immunodeficiency syndromes, hematologic malignancies) with focal neurologic symptoms, headaches, behavioral, cognitive or personality changes

For evaluation of clinical assessment documenting cognitive impairment of unclear cause
(Harvey 2012; HQO, 2014; Narayanan, 2016)

- Mental status score of either MMSE or MoCA of less than 26 or other similar mental status instruments*/**forma**l neuropsychological testing showing at least mild cognitive impairment AND a completed basic metabolic workup (such as thyroid function testing, liver function testing, complete blood count, electrolytes, and B12)

  ***Other examples include: Ottawa 3DY (O3DY), Brief Alzheimer's Screen (BAS), Blessed Dementia Scale (BDS), caregiver-completed AD8 (cAD8), Brief Cognitive Rating Scale (BCRS), Clinical Dementia Rating (CDR) (Carpenter, 2011; McDougall, 1990)**

FDA labeling for the drug Aduhelm (for Alzheimer's disease) requires baseline imaging and monitoring with Brain MRI. Criteria for coverage includes the following:

- **Baseline study within 1 year of initiating treatment**
- **Prior to the 7th and 12th infusions**
- **Monitoring if radiographic severe Amyloid Related Imaging Abnormalities (ARIA) is observed**

For evaluation of movement disorders
(ACR, **2019e**; Albanese, 2011; Mascalchi, 2012; McFarland, 2014; Pyatigorskaya, 2014; Sharifi, 2014)

- For evaluation of suspected Parkinson's with atypical feature or unresponsive to levodopa
- For evaluation of new non-Parkinson symptoms in known Parkinson's disease complicating the evaluation of the current condition
- For the evaluation of other movement disorder to exclude a structural lesion (i.e., suspected Huntington disease, chorea, atypical parkinsonian syndromes, hemiballismus, atypical dystonia)

Note: MRI not indicated in essential tremor or isolated focal dystonia (e.g., blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia) (Alabanese, 2011; Comella, 2019; Sharfi, 2014)

For evaluation of cranial nerve and visual abnormalities

- Anosmia (loss of smell) **or dysosmia** documented by objective testing that is persistent and of unknown origin (**Decker, 2013**; Policeni, 2017; Rouby, 2011)
- Optic neuritis
- Abnormal eye findings on physical or neurologic examination (papilledema, pathologic nystagmus, **optic atrophy,** ocular nerve palsies, new onset anisocoria, visual field deficit, etc.) (Chang, 2019)
  Note: Not explained by underlying ocular diagnosis, glaucoma, or macular degeneration
- Binocular diplopia with concern for intracranial pathology (Iliescu, 2017)
- **Childhood strabismus with development delay or abnormal fundoscopic exam to rule out intracranial abnormalities (Kadom, 2008; Yoon, 2019**)
- Horner's syndrome with symptoms localizing the lesion to the central nervous system (Lee, 2007)
- Trigeminal **n**euralgia **or other trigeminal autonomic cephalgias**, **notably in those with atypical presentation (Bendtsen, 2019; Cruccu, 2016; Wilbrink, 2009)**
- Bell's Palsy- if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset (Quesnel, 2010)
- Hemifacial spasm (Hermier, 2019)
- Other objective cranial nerve palsy (CN IX-XII) (ACR, 2017**b**; Mumtaz, 2014; Policeni, 2017)
- **Bulbar symptoms, i.e., difficulty in chewing, weakness of the facial muscles, dysarthria, palatal weakness, dysphagia, and dysphonia and/or signs, i.e., atrophy and fasciculations of the tongue and absent gag reflex (Yedavelli, 2018)**
- **Pseudobulbar symptoms, i.e., dysphagia, dysarthria, facial weakness, sudden, stereotyped emotional outbursts that are not reflective of mood and/or signs, i.e., spastic tongue and exaggerated gag/jaw jerk (King, 2013)**

For evaluation of known or suspected congenital abnormality (such as craniosynostosis, **neural tube defects**) (Ashwal, 2009; Vinocur, 2010)

- Known or suspected congenital abnormality with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Evaluation of macrocephaly in an infant/child <**18 with** previously abnormal US, abnormal neurodevelopmental examination (Tan, 2018), signs of increased ICP or closed anterior fontanelle
- Evaluation of **microcephaly in an infant/child < 18**
- Evaluation of craniosynostosis and other skull deformities. CT is preferred imaging to assess bony structures; MRI imaging is preferred to assess intracranial soft tissue
- **Evaluation of the corticomedullary junction in Achondroplasia (Dougherty,2018; Kubota, 2020))**
- Prior treatment OR treatment planned for congenital abnormality
  Note: **For evaluation of known or suspected hydrocephalus please see section on CSF abnormalities.**

Cerebral Spinal Fluid (CSF) Abnormalities

- **Evaluation of suspected hydrocephalus with any acute, new, or fluctuating neurologic, motor, or mental status changes**
- Known hydrocephalus†
- **For initial evaluation of** a suspected Arnold Chiari malformation†
- **Follow-up imaging of a known type II or type III Arnold Chiari malformation†. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms (Whitson, 2015)**
- Initial evaluation for a known syrinx or syringomyelia†
- Known or suspected normal pressure hydrocephalus (NPH) (Damasceno, 2015)
  - With symptoms of gait difficulty, cognitive disturbance, and urinary incontinence
- Follow-up shunt evaluation (Kamenova, 2018; Pople, 2002, Reddy, 2014; **Wetzel, 2018**)
  - Post operativity if indicated based on underlying disease **or** pre-operative radiographic findings and/or
  - 6-12 months after placement and/or
  - With neurologic symptoms that suggest shunt malfunction
- Evaluation of known or suspected cerebrospinal fluid (CSF) leakage (Severson, 2019)
- **Cisternography for intermittent and complex CSF rhinorrhea/otorrhea. CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay) (Mantur, 2011; Selcuk, 2010)**
- Suspected spontaneous intra-cranial hypotension with distinct postural headache (other symptoms include nausea, vomiting, dizziness, tinnitus, diplopia neck pain or imbalance) (Gordon 2009; NORD, 2017).
- CSF flow study for evaluation and management of CSF flow disorders (Bradley, 2016; Mohammad, 2019)

†Often congenital, but can present later in life; or less commonly acquired secondary to tumor, stroke, trauma, infection, etc. (NORD, 2014)

Pre-operative/procedural evaluation for brain/skull surgery

- **Pre-operative evaluation for a planned surgery or procedure**

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications for a Brain MRI

- Vertigo associated with any of the following (**Kattah, 2009**; Welgampola, 2019; Yamada, 2019)
  - Signs or symptoms suggestive of a CNS lesion (ataxia, visual loss, double vision, weakness, or a change in sensation)
  - Progressive unilateral hearing loss
  - Risk factors for cerebrovascular disease with concern for stroke
  - After full neurologic examination and vestibular testing with concern for central vertigo **(i.e., skew deviation, vertical nystagmus, head thrust test, videonystagmography (VNG)/ electronystagmography (ENG))**
- **Diagnosis of central sleep apnea on polysomnogram**

    - Children > 1 year (Felix, 2016)
    - Adults in the absence of heart failure, chronic opioid use, high altitude, or treatment emergent central sleep apnea AND concern for a central neurological cause (Chiari malformation, tumor, infectious/inflammatory disease) OR with an abnormal neurological exam (Malhotra, 2010)
- Syncope with clinical concern for seizure or associated neurological signs or symptoms (Al-Nsoor, 2010; Strickberger, 2006)
- Cyclical vomiting syndrome or abdominal migraine with any localizing neurological symptoms (Angus-Leppan, 2018; Li, 2018; **Thangam**, 2019)
- Soft tissue mass of the head with nondiagnostic initial evaluation (ultrasound and/or radiograph) (ACR, 2017**c**; Kim, 2019; Zhang, 2018)
- Psychological changes with neurological deficits on exam or after completion of a full neurological assessment that suggests a possible neurologic cause (ACR, 2019b)
- Global developmental delay or developmental delay with abnormal neurological examination **in a child < 18 years** (Ali, 2015; Momen, 2011)
- Cerebral palsy if etiology has not been established **in** the neonatal period, there is change in the expected clinical or developmental profile or concern for progressive neurological disorder (Ashwal, 2004; NICE, 2020)
- Unexplained event (BRUE) formerly apparent life-threatening event (ALTE) in infants < 1 year with concern for neurological cause based on history and exam (Tieder, 2016)
  Note: Imaging is not indicated in low-risk patients

Indications for a Brain MRI with Internal Auditory Canal (IAC)

- Unilateral non-pulsatile tinnitus
- Pulsatile tinnitus
- Suspected acoustic neuroma (Schwannoma) or cerebellar pontine angle tumor with any of the following signs and symptoms: unilateral hearing loss by audiometry, headache, disturbed balance or gait, unilateral tinnitus, facial weakness, or altered sense of taste
- Suspected cholesteatoma
- Suspected glomus tumor
- Asymmetric sensorineural hearing loss on audiogram
- CSF otorrhea (MRI for intermittent leak, CT for active leaks) (Hiremath, 2019) **CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)**
- Clinical suspicion of acute mastoiditis as a complication of acute otitis media with intracranial complications (i.e., meningeal signs, cranial nerve deficits, focal neurological findings, altered mental status) (Patel, 2014; Platzek, 2014)
- Bell's Palsy for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset (Quesnel, 2010)

Indications for Combination Studies

(ACR, 2017**a**, 2019**a**)

- For approved indications as noted above and being performed in a child under 8 years of age who

will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology **(Lawson, 2000)**

- **Brain MRI/Neck MRA**
  - Recent ischemic stroke or transient ischemic attack
  - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits

- **Brain MRI/Brain MRA**
  - Recent ischemic stroke or transient ischemic attack
  - Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up (Whitehead, 2019, Yeh, 2010, Yuan, 2005):
    - Negative Brain CT; **AND**
    - Negative Lumbar Puncture
  - Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
  - **Headache associated with exercise or sexual activity (IHS, 2018)**
  - Suspected venous thrombosis (dural sinus thrombosis) – Brain MRV see **background**

- **Brain MRI/Brain MRA/Neck MRA**
  - Recent stroke or transient ischemic attack (TIA)
  - **Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits**

- **Brain MRI/ Cervical MRI/Thoracic MRI (any combination)**
  - **For evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis) (Wingerchuk, 2015)**
  - **For known MS, prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)**
  - **Follow-up scans for known MS if patients have known spine disease (Kaunzner, 2017)**
    - **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**

- **Brain MRI/ Cervical MRI/Thoracic MRI/Lumbar (any combination)**
  - **Follow-up imaging of a known type II or type III Arnold Chiari malformation†. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms (Radic, 2018; Whitson, 2015)**
  - **Suspected Leptomeningeal carcinomatosis (see background) (Shah, 2011)**
  - **Tumor evaluation and monitoring in neurocutaneous syndromes - See background**
  - **CSF leak highly suspected and supported by patient history and/or physical exam findings (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)**

- **Brain MRI/Orbit MRI**
    - **Optic neuropathy or unilateral optic disk swelling** of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infitrative disorders (Behbehani, 2007)
    - Bilateral optic disk swelling (papilledema) with visual loss (Margolin, 2019)
    - Optic Neuritis
        - If atypical presentation, severe visual impairment, or poor recovery following initial onset or treatment onset (CMSC, 2018)
        - **If needed to confirm optic neuritis and rule out compressive lesions**
    - Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis (Wingerchuk, 2015)

- **Brain MRI/FACE/SINUS/NECK MRI**
    - **Anosmia or dysosmia** on objective testing **that is persistent and of unknown origin (Decker, 2013;** Policeni, 2017; Zaghouani, 2013)
    - Granulomatosis with polyangiitis (Wegener's granulomatosis) disease (Pakalniskis, 2015)
    - **Trigeminal Neuralgia or other trigeminal autonomic cephalgias, notably in those with atypical presentation** (Hughes, 2016; Policeni, 2017)
    - Bells/hemifacial spasm that meets above criteria
    - Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course) (Mumtaz, 2014; Policeni, 2017)

BACKGROUND

Brain (head) MRI is the procedure of choice for most brain disorders. It provides clear images of the brainstem and posterior brain, which are difficult to view on a CT scan. It is also useful for the diagnosis of demyelinating disorders (such as multiple sclerosis (MS) that cause destruction of the myelin sheath of the nerve). The evaluation of blood flow and the flow of cerebrospinal fluid (CSF) is possible with this non-invasive procedure.

MRI for Headache – Generally, magnetic resonance imaging is the preferred imaging technique for evaluating the brain parenchyma, and CT is preferable for evaluating subarachnoid hemorrhage. CT is faster and more readily available than MRI and is often used in urgent clinical situations. Neurologic imaging is warranted in patients with headache disorders along with abnormal neurologic examination results or predisposing factors for brain pathology. Contrast-enhanced MRI is performed for evaluation of inflammatory, infectious, neoplastic, and demyelinating conditions.

Headache timeframes and other characteristics – Generally, acute headaches are present from hours to days, subacute from days to weeks and chronic headaches for more than 3 months. Acute severe headaches are more likely to be pathological (e.g., SAH, cerebral venous thrombosis) than non-acute (e.g., migraine, tension-type). Headaches can also be categorized as new onset or chronic/recurrent. Non-acute new onset headaches do not require imag**ing** unless there is a red flag as delineated above.

Incidental findings lead to additional medical procedures and expense that do not improve patient well-being. Primary headache syndromes, such as migraine and tension headaches, are often episodic with persistent or progressive headache not responding to treatment requiring further investigation (e.g., new daily persistent headache). Imaging is indicated in chronic headaches if there is a change in the headache frequency (number of headaches episodes/month), duration of each episode, severity of the headaches or new characteristics, such as changing aura or associated symptoms (ACR, **2019c**; **IHS**, 2018; Jang, 2019; Spierings, 2003; Tyagi, 2012)

Migraine with aura (Hadjikhani, 2019; IHS, 2018; Micieli, 2020) – The headache phase of a migraine is preceded and/or accompanied by transient neurological symptoms referred to as aura in at least a third of migraine attacks. The most common aura consists of positive and/or negative visual phenomena, present in up to 99% of the patients. Somatosensory is the secondary most common type of aura (mostly paraesthesias in an upper limb and/or hemiface). Language/speech (mainly paraphasia and anomic aphasia) can also be affected. These neurological symptoms typically evolve over a period of minutes and may last up to 20 minutes or more. The gradual evolution of symptoms is thought to reflect spreading of a neurological event across the visual and somatosensory cortices. Characteristically, the aura usually precedes and terminates prior to headache, usually within 60 minutes. In others, it may persist or begin during the headache phase. ICHD-3 definition of the aura of migraine with typical aura consists of visual and/or sensory and/or speech/language symptoms, but no motor, brainstem or retinal symptoms and is characterized by gradual development, duration of each symptom no longer than one hour, a mix of positive and negative features and complete reversibility. Atypical or complex aura includes motor, brainstem, monocular visual disturbances, or ocular cranial nerve involvement (hemiplegic migraine, basilar migraine/brainstem aura, retinal migraine, ophthalmoplegic migraine) and secondary causes need to be excluded. Additional features of an aura that raise concern for an underlying vascular etiology include late age of onset, short duration, evolution of the focal symptoms, negative rather than positive visual phenomenon, and history of vascular risk factors.

Table 1: Gait and brain 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, if there is 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)

Non-neurological causes of gait dysfunction include pain (antalgic), side effects of drugs (analgesic, antihistamines, benzos, psych meds, antihypertensives), visual loss, hearing impairment, orthopedic disorders, rheumatologic disorders, psychogenic, and cardiorespiratory problems (orthostasis) (Foster 2021; Haynes, 2018; Marshall, 2012; Pirker 2017).

MRI and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms" (Sacco, 2013). If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes (Kernan, 2014). TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging" (Easton, 2009). On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention (Hong, 2011).

Therefore, when revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis ((Easton, 2009).

Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation as the cause of ischemic symptoms (Kernan, 2014). Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable (Wintermark, 2013). Patients with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

MRI and Central Venous Thrombosis – a **MR** Venogram is indic**a**ted for the definite evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome, seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6-weeks postpartum), infections, and trauma. **COVID-19 infection is associated with hypercoagulability, a thromboinflammatory response, and an increased incidence of venous thromboembolic events (VTE) (Connors, 2020; Tu, 2020)**. Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate (Bushnell, 2014; Courinho, 2015; Ferro, 2016).

MRI and benign tumors (e.g., schwannomas, choroid plexus papilloma, pineocytoma, gangliocytoma) A single follow-up study is appropriate after the initial diagnosis to ensure stability. Follow-up of known benign tumor **is indicated** if symptomatic, new/changing signs or symptoms, or complicating factors (Gupta, 2017). In neurocutaneous and hereditary cancer syndromes, follow-up surveillance may also be indic**a**ted (see below).

Galactorrhea and MRI - Imaging is not indicated in isolated galactorrhea without elevated prolactin (normoprolactinemic) (**Atluri, 2018**; Huang, 2012).

MRI and Meningioma (NHS, 2018) – For incidental meningiomas, most patients who progressed did so within 5 years of diagnosis (Islim, 2019). Small (<2cm) meningiomas rarely grow sufficiently to produce symptoms within 5 years. Heavily calcified meningiomas rarely grow. Patients with multiple meningiomas should have annual scans indefinitely, despite treatment, because of the possibility of further meningiomas developing.
For surveillance post-treatment:

- Solitary convexity WHO Grade 1 meningiomas - MRI scan at 2½ years post-operatively.
- Solitary skull base or falcine origin WHO Grade 1 meningiomas- MRI scans at 1 year, 2 years, 3½ years and 5 years post-operatively. If a recurrence is detected, continue annual scans.
- WHO Grade 2 meningiomas- MRI scan at 6 months, 1 **year** then annually to 5 years. If a recurrence is detected, continue annual scans.
- WHO Grade 3 meningiomas - 6-monthly MRI scans for 3 years, then annual scans to 5 years. If a recurrence is detected, continue annual scans.

- Patients who have had radiosurgery, including those being treated for a recurrence, should have scans at 6 months, then annually for 3 years, a scan at 5 years and a final scan at 10 years.

Table 2: MRI and staging screening in Non-CNS Cancers (NCCN, 2020)

(NON-BRAIN/CNS) CANCER	PRECONDITION
Cutaneous melanoma	Stage IIIC or higher, default staging screening ≥ stage IIIC, surveillance with periodic brain MRI up to 3 years even if asymptomatic without prior brain mets; and if prior brain mets, surveillance every 3-6 months up to 3 years
Testicular cancer-Seminoma	If high risk, such as beta HCG >5000IU/L, or multiple lung or visceral mets, choriocarcinoma, neurological symptoms, or AFP>10,000ng/ml
Merkel cell carcinoma	Default staging screening, but especially for high risk (≥stage IIIb, immunosuppression)
Lung cancer	Default staging screening brain MRI also for surveillance in small cell every 3 months for 2 years if they have had no prophylactic cranial radiation

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, most 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 (Rednam, 2017).**
- **In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement only after age 1 and is recommended in patients <1 year only if symptomatic (Comi, 2011).**

MRI and Positron Emission Tomography (PET) for Chronic Seizures – When MRI is performed in the evaluation of patients for epilepsy surgery, almost a third of those with electrographic evidence of temporal lobe epilepsy have normal MRI scans. Interictal positron emission tomography (PET) may be used to differentiate patients with MRI-negative temporal lobe epilepsy.

Multiple Sclerosis (Rovira, 201**5**; Saguil, 2014; Thompson, 201**8**) – The diagnosis of MS requires demonstration of lesions in the CNS disseminated in time and space and the absence of fever,

infection, or other more likely etiologies. There is an expanding amount of available disease-modifying treatments **that** are effective in slowing down disease progression, especially in the early stages. **These treatments** can have serious side effects **and can be costly;** therefore, the accurate and expeditious diagnosis of MS is critical.

The diagnosis of MS can be made on clinical presentation alone with 2 clinical attacks and objective clinical evidence of more than 2 lesions. Attacks may be patient-reported or objectively observed and must last for a minimum of 24 hours and be 30 days apart. However, corroborating magnetic resonance imaging (MRI) is the diagnostic standard and is used, as well, to rule out other disorders. Additionally, MRI findings can replace certain clinical criteria in a substantial number of patients. In the revised McDonald Criteria, MRI findings can be used to establish dissemination in both time and space.

Table 3: Variable Symptoms and Signs of MS

Symptoms	*Signs*
Depressed mood	**Ataxia**
Memory loss/cognitive changes	**Dysmetria**
Dizziness or vertigo	**Decreased sensation (pain, vibration, position)**
Fatigue	**Decreased strength**
Hearing loss and tinnitus	**Hyperreflexia, spasticity**
Heat sensitivity (Uhthoff Phenomenon)	**Nystagmus**
Incoordination and gait disturbances	**Lhermitte's sign**
Sensory disturbances (dysesthesias, numbness, paresthesias)	**Visual defects (internuclear ophthalmoplegia, optic disc pallor, red color desaturation, reduced visual acuity)**
Pain	
Urinary symptoms	
Visual disturbances (diplopia, oscillopsia)	
Weakness	

In the presence of a clear, clinically isolated syndrome such as optic neuritis, transverse myelitis, or brain stem syndrome, brain MRI is the next diagnostic step. MS can also have variable and often subjective symptoms that come and go (see **Table 3**). If there are recurrent episodes of variable

neurological signs or symptoms not attributable to another cause with clinical concern for MS, imaging is warranted as well.

MRI and Neuromyelitis optica spectrum disorders (NMOSD) (Wingerchuk, 2015) - NMOSD are inflammatory disorders of the central nervous system characterized by severe, immune-mediated demyelination and axonal damage predominantly affecting the optic nerves and spinal cord, but also the brain and brainstem. NMOSD can be distinguished from multiple sclerosis and other inflammatory disorders by the presence of the aquaporin-4 (AQP4) antibody. Features of NMOSD include attacks of bilateral or sequential optic neuritis acute transverse myelitis and the area postrema syndrome (with intractable hiccups or nausea and vomiting). The evaluation of suspected NMOSD entails brain and spinal cord neuroimaging. In contrast to MS (in which spinal cord involvement tends to be incomplete and asymmetric), NMOSD have a longer extent of spinal cord demyelination generally involving three or more vertebral segments.

Temporal Arteritis - Giant cell arteritis (GCA) is an inflammatory disorder that should be considered in patients over the age of 50 with the following signs or symptoms: new headaches, acute onset of visual disturbances (especially transient monocular visual loss), jaw claudication, constitutional symptoms, tenderness over the temporal artery, and elevated ESR and/or CRP. A diagnosis of polymyalgia rheumatica (PMR) is highly associated. Large vessel GCA denotes involvement of the aorta and its first-order branches, especially the subclavian arteries, and is common. Extra- and intracranial cerebral vasculitis can also be seen, but is more rare, and strokes are related to vasculitis of extracranial cerebral arteries causing vertebral or internal carotid arteries stenosis. Gold standard for diagnosis of GCA is temporal artery biopsy. Color Doppler ultrasound (CDUS) can be used as a surrogate for temporal artery biopsy in some cases. High-resolution magnetic resonance imaging (MRI) can visualize the temporal arteries when used with contrast. The presence of clinical manifestations unusual in GCA should prompt consideration of alternative diagnoses. Examples of such include adenopathy, pulmonary infiltrates, digital cyanosis, ulceration or gangrene, mononeuritis multiplex, stroke in the distribution of the middle cerebral artery, glomerulitis, and/or rapidly rising creatinine (Diamantopoulos, 2014; D'Souza, 2016; Klink, 2014; Larivière, 2014; Salehi, 2016; Yip 2020).

MMSE - The Mini Mental State Examination (MMSE) is a tool that can be used to systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The MMSE has been the most commonly used measure of cognitive function in dementia research, but researchers have recognized that it is relatively insensitive and variable in mildly impaired individuals. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is, therefore, practical to use repeatedly and routinely.

MoCA - The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. MoCA differs from the MMSE mainly by including tests of executive function and abstraction, and by putting less weight on orientation to time and place. Ten of the MMSE's 30 points

are scored solely on the time-place orientation test, whereas the MoCA assigns it a maximum of six points. The MoCA also puts more weight on recall and attention-calculation performance, while de-emphasizing language skill. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

MRI and Movement disorders - Atypical parkinsonian syndromes include progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBD), and dementia with Lewy bodies.

Anosmia - Nonstructural causes of anosmia include post-viral symptoms, medications (**Amitriptyline**, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifl**uo**perazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause.

Anosmia and dysgeusia have been reported as common early symptoms in patients with COVID-19, occurring in greater than 80 percent of patients. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made given the high association. As such, COVID testing should be done prior to imaging (Geyer, 2008; Lechien, 2020; Saniasiaya, 2021).

Evaluation of olfactory function is essential to determine the degree of chemosensory loss and confirm the patient's complaint. It also allows monitoring of olfactory function over time, helps to detect malingerers, and to establish compensation for disability. There are two general types of olfactory testing: psychophysical and electrophysiologic testing. Psychophysical tests are used for clinical evaluation of olfactory loss; whereas, electrophysiologic tests, such as electro-olfactogram (EOG) or odor event–related potentials (OERPs) are used for research purposes only.

Olfactory threshold tests rely on measuring detection thresholds of a specific odorant, such as phenyl ethyl alcohol (PEA) or butyl alcohol. Odor identification tests are quantitative tests in which patients are asked to identify the odorants at the suprathreshold level. Examples include *The Connecticut odor identification, The University of Pennsylvania Identification Test (UPSIT) and the Cross-Cultural Smell Identification Test (CC-SIT)*. In Europe, a commonly used test is a threshold- and odorant-identification forced-choice test that uses odorant-impregnated felt-tipped pens (Sniffin' Sticks). A simple olfactory screening test using a 70% isopropyl alcohol pad as a stimulant has also been well described in the literature (Wrobel, 2004).

MRI for Macrocephaly - Consider ultrasound in infants with macrocephaly and a normal neurological examination, no evidence of increased ICP and an open anterior fontanelle. If head US is normal, the infant should be monitored closely (Smith, 1998). The anterior fontanelle generally closes between 10 and 24 months of age, with 3% closing between 5-9 months and 11% after 24 months (Pindrik, 2014).

MRI and Normal Pressure Hydrocephalus (NPH) - Although diagnosis can be made based on CT findings alone, MRI is more accurate for disclosing associated pathologies (such as cerebrovascular disease), excluding other potential etiologies and for detecting NPH typical signs of prognostic value. A CT scan can exclude NPH and is appropriate for screening purposes and in patients who cannot undergo MRI (Damasceno, 2015).

MRI and Vertigo – The most common causes of vertigo seen are benign paroxysmal positional vertigo (BPPV), vestibular neuronitis (VN) and Ménière's disease. These peripheral causes of vertigo are benign, and treatment involves reassurance and management of symptoms. Central causes of vertigo, such as cerebrovascular accidents (CVAs), tumors and multiple sclerosis (MS), need to be considered if the patient presents with associated neurological symptoms, such as weakness, diplopia, sensory changes, ataxia, or confusion. Magnetic resonance imaging is appropriate in the evaluation of patients with vertigo who have neurologic signs and symptoms, progressive unilateral hearing loss or risk factors for cerebrovascular disease. MRI is more appropriate than CT for diagnosing vertigo due to its superiority in visualizing the posterior portion of the brain, where most central nervous system disease that causes vertigo is found. A full neurologic and otologic evaluation including provocative maneuvers, vestibular function testing and audiogram can help evaluate vertigo of unclear etiology and differentiate between central and peripheral vertigo.

MRI and developmental delay – Significant developmental delay is defined as significant delay (more than two standard deviations below the mean) in one or more developmental domains: gross/fine motor, speech/language, cognition, social/personal, and activities of daily living. Isolated delay in social/language development is characteristic of autism spectrum disorders or hearing loss. Isolated delay in motor development is characteristic of cerebral palsy (a static encephalopathy) or myopathy. Global developmental delay (GDD) **is** a subset of developmental delay defined as significant delay (by at least 2 SD's) in two or more developmental categories. Note that the term "GDD" is usually reserved for children <5 years old, whereas in older children >5 years, disability is quantifiable with IQ testing.

Low risk brief resolved unexplained event (BRUE) formerly apparent life-threatening event (ALTE) requires all the following:

- Age > 60 days
- Gestational age ≥ 32 weeks or older and corrected gestational age $\underline{\geq}$ 45 weeks
- First brief event
- Event lasting < 1 minute
- No CPR required by the trained medical provider
- No concerning historical features or physical examination findings.

Combination MRI/MRA of the Brain – This is one of the most misused combination studies and other than what is indicated above these examinations should be ordered in sequence, not together. Vascular abnormalities can be visualized on the brain MRI.

Patients presenting with a new migraine with aura (especially an atypical or complex aura) can mimic a transient ischemic attack or an acute stroke. If there is a new neurologic deficit, imaging should be guided by concern for cerebrovascular disease, not that the patient has a headache (**Nahas**, 2019).

Leptomeningeal Carcinomatosis (**Andersen, 2019; Clarke, 2010; Maillie, 2021; Wang, 2018) – Leptomeningeal metastasis is an uncommon and typically late complication of cancer with poor prognosis and limited treatment options. Diagnosis is often challenging with nonspecific presenting symptoms ranging from headache and confusion to focal neurologic deficits such as cranial nerve**

palsies. Standard diagnostic evaluation involves a neurologic examination, MRI of the brain and spine with gadolinium, and cytologic evaluation of the cerebral spinal fluid (CSF). Hematologic malignancies (leukemia and lymphoma), primary brain tumors as well as solid malignancies can spread to the leptomeninges. The most common solid tumors giving rise to LM are breast cancer (12 - 35 %), small and non-small cell lung cancer (10-26 %), melanoma (5 -25 %), gastrointestinal malignancies (4-14 %), and cancers of unknown primary (1-7 %).

POLICY HISTORY

Date	Summary
July 2021	**Reordered Indications** **Updated references** **Updated background section** **Added** • **Brain MR/MRA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain MR/Brain MRA combination studies section.** • **Cluster headaches or other trigeminal-autonomic cephalgias i.e. paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks (SUNCT/SUNA) imaging is indicated once to eliminate secondary causes (IHS, 2018)** • **Note: MRI is the study of choice for detecting cavernous malformations (CCM). Follow-up imaging of known CCM should be done only to guide treatment decisions or to investigate new symptoms. First-degree relatives of patients with more than one family member with a CCM should also have a screening MRI as well as genetic counseling** • **Langerhans cell histiocytosis with visual, neurological, or endocrine abnormality; polyuria or polydipsia; suspected craniofacial bone lesions, aural discharge, or suspected hearing impairment/mastoid involvement** • **Langerhans cell histiocytosis -To assess treatment response and surveillance of known brain lesions** • **Progressive Multifocal Leukoencephalopathy (PML) surveillance for patients on natalizumab (Tsyabri)** o **12 months after the start of treatment in all patients** o **Further surveillance MRI scanning timing is based on anti-JCV antibody status** ▪ **If anti-JCV antibody negative, annually** ▪ **If anti-JCV antibody positive and antibody index < 1.5. every 6 months** ▪ **If anti-JCV antibody positive and antibody index > 1.5, every 3-4 months**

	• **Temporal Arteritis: Note: Protocol should include high-resolution contrast-enhanced imaging the temporal artery** • **similar mental status instruments */formal neuropsychological *Other examples include Ottawa 3DY (O3DY), Brief Alzheimer's Screen (BAS), Blessed Dementia Scale (BDS), caregiver-completed AD8 (cAD8), Brief Cognitive Rating Scale (BCRS), Clinical Dementia Rating (CDR) (Carptenter, 2011; McDougall, 1990)** • **FDA labeling for the drug Aduhelm (for Alzheimer's disease) requires baseline imaging and monitoring with Brain MRI. Criteria for coverage includes the following:** o **Baseline study within 1 year of initiating treatment** o **Prior to the 7th and 12th infusions** o **Monitoring if radiographic severe Amyloid Related Imaging Abnormalities (ARIA) is observed** • **Optic atrophy as an abnormal eye finding** • **Childhood strabismus with development delay or abnormal fundoscopic exam to rule out intracranial abnormalities** • **Bulbar symptoms ie. difficulty in chewing, weakness of the facial muscles, dysarthria, palatal weakness, dysphagia, and dysphonia and/or signs i.e. atrophy and fasciculations of the tongue and absent gag reflex** • **Pseudobulbar symptoms i.e. dysphagia, dysarthria, facial weakness, sudden, stereotyped emotional outbursts that are not reflective of mood and/or signs i.e. spastic tongue and exaggerated gag/jaw jerk** • **Evaluation of the corticomedullary junction in Achondroplasia** • **Evaluation of suspected hydrocephalus with any acute, new, or fluctuating neurologic, motor, or mental status changes (separated this from known hydrocephalus)** • **Cisternography for intermittent and complex CSF rhinorrhea/otorrhea. CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay).** • **Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits to Brain MRI/Brain MRA/Neck MRA combo** • **Headache associated with exercise or sexual activity (Brain MRI/Brain MRA combo)** • **Pre-operative evaluation for a planned surgery or procedure** **Brain MRI/ Cervical MRI/Thoracic MRI (any combination)** o **For evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)** o **For known MS, prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)**

	o **Follow -up scans for known MS 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** **Brain MRI/ Cervical MRI/Thoracic MRI/Lumbar (any combination)** • **Follow up imaging of a known Arnold Chiari malformation (II/III). For Chiari, I follow-up imaging only if new or changing signs/symptoms** o **Suspected Leptomeningeal carcinomatosis (LC)** o **Tumor evaluation and monitoring in neurocutaneous syndromes - See Background** o **CSF leak highly suspected and supported by patient history and/or physical exam findings (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)** **Brain MRI/Orbit MRI Optic Neuritis- If needed to confirm optic neuritis and rule out compressive lesions** **Clarified** • **Symptoms indicative of increased intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting** • **Suspected stroke with a personal or first-degree family history (brother, sister, parent, or child) of aneurysm or known coagulopathy or on anticoagulation** • **Symptoms of transient ischemic attack (TIA) (episodic neurologic symptoms such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes)** • **Known or suspected skull fracture by physical exam and/or prior imaging** • **Neurologic findings (e.g. visual field deficit suggesting compression of the optic chiasm, diplopia, gaze palsy) – Pituitary** • **Follow-up known of pituitary adenoma - New neuroendocrine signs or symptoms** • **Follow of known arachnoid cyst (Al-Holou, 2010, 2013; Mustansir, 2018)** o **> 4 years old, repeat imaging only if newly symptomatic i.e. headaches, increased intracranial pressure, hydrocephalus, local mass effect, seizures, visual/endocrine dysfunction.** • **Temporal Arteritis - Atypical features, failure to response to treatment or concern for intracranial involvement**

	• **Central Nervous System (CNS) involvement in patients with known or suspected vasculitis or autoimmune disease with abnormal inflammatory markers or autoimmune antibodies** • **Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up** • **Anosmia or dysosmia on objective testing that is persistent and of unknown origin (also in combo section)** • **Trigeminal Neuralgia or other trigeminal autonomic cephalgias, notably in those with atypical presentation (also in combo section)** • **Clarified age < 18 for imaging of microcephaly and macrocephaly** • **For initial evaluation of a suspected Arnold Chiari malformation** • **For follow up imaging of a known Arnold Chiari malformation (II/III). For Chiari I follow-up imaging only if new or changing signs/symptoms** • **After full neurologic examination and vestibular testing with concern for central vertigo (i.e. skew deviation, vertical nystagmus, head thrust test, videonystagmography (VNG)/electronystagmography (ENG))** • **Clarified age < 18 for imaging of developmental delay** • **Brain with IAC - CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay).** • **Optic neuropathy or unilateral optic disk swelling of unclear etiology (Brain MRI/Orbit MRI)** **Deleted** • **Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent vascular and intracranial pathology (redundant)** • **Brain MRI/Cervical MRI combo section (included in Brain MRI/ Cervical MRI/Thoracic MRI/Lumbar combos)**
May 2020	**Clarified:** • **New onset headache with (neurologic deficit) or with signs of increased intracranial pressure (papilledema)** • **Special additional considerations in the pediatric population with persistent headache** o **Documented absence of family history of headache** • **For evaluation of known or suspected stroke or vascular disease:** • **Suspected brain tumor**

	• **Suspected brain metastasis or intracranial involvement in patients with a history of cancer based on neurological symptoms or examination findings** • **Follow up of known malignant brain tumor** **Clarified:** • **Patient with history of CNS cancer (either primary or secondary) and a recent course of chemotherapy, radiation therapy (to the brain), or surgical treatment within the last two (2) years** • **Follow up of known non-malignant brain tumor/lesion if symptomatic, new/changing signs or symptoms or complicating factors** • **New onset of an unprovoked seizure in adults** • **Suspected intracranial abscess or brain infection** • **Suspected Encephalitis with headache and altered mental status or follow-up as clinically warranted** • **Mental status score of either MMSE or MoCA of less than 26 or other similar mental status instruments/neuropsychological testing** **Clarified:** • **Anosmia (loss of smell) documented by objective testing that is persistent and of unknown origin** • **Chiari malformation/syrinx Often congenital, but can present later in life; or less commonly acquired secondary to tumor, stroke, trauma, infection etc.** • **Vertigo associated with any of the following** o **Risk factors for cerebrovascular disease with concern for stroke** o **After full neurologic examination and vestibular testing with concern for central vertigo** • **Combo Brain MRI/Orbit MRI** o **Reworded: Unilateral optic disk swelling/optic neuropathy of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders** o **Bilateral optic disk swelling (papilledema) with vision loss** **Added:** • **Visual loss (as a neurological deficit) Not explained by underlying ocular diagnosis, glaucoma or macular degeneration**

	• **Under New acute headache, sudden onset:**
	  o **With a personal or family history of brain aneurysm or AVM (arteriovenous malformation)**
	  o **Known coagulopathy or on anticoagulation**
	• **Under New onset of headache and any of the following**
	  o **Fever**
	  o **Subacute head trauma**
	  o **Pregnancy or puerperium**
	  o **Age ≥ 50**
	  o **Neurological deficits - Note: Neuroimaging warranted for atypical/complex migraine aura, but not for a typical migraine aura (see background)**
	Added:
	• **Special additional considerations in the pediatric population with persistent headache**
	  o **Symptoms indicative of intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting**
	  o **Severe headache in a child with an underlying disease that predisposes to intracranial pathology (e.g.; immune deficiency, sickle cell disease neurofibromatosis, history of neoplasm, coagulopathy, hypertension, congenital heart disease)**
	• **Suspected stroke with a personal or family history (brother, sister, parent or child) of aneurysm or known coagulopathy/anticoagulation**
	
	Added:
	• **Suspected Pituitary Tumors:**
	  o **With the following:**
	  ▪ **Neurologic findings (e.g. visual field deficit suggesting compression of the optic chiasm)**
	  ▪ **Suspected hypofunctioning pituitary gland based on hormonal testing e.g., hypo pituitarism, growth hormone deficiency, hypogonadotropic hypogonadism [i.e. low gonadotropins (FSH/LH) and sex hormones*]**
	  ▪ *** severe secondary hypogonadism with total testosterone persistently < 150 and low or normal LH/FSH OR**
	  ▪ *** testosterone levels below normal range with low or normal LH/FSH AND**

	• **neurological sign and symptoms OR** • **other pituitary hormonal abnormalities OR** • **consideration of reversible functional causes of gonadotropin suppression (e.g. obesity, opioid use, or comorbid illness)** **Added:** • **Suspected hyperfunctioning pituitary gland based on hormonal testing i.e., central hyperthyroidism (high TSH), Cushing disease (high ACTH), acromegaly/gigantism (high GH/IGF-1) or elevated prolactin (>250 ng/mL or persistently elevated in the absence of another cause eg. stress, pregnancy, hypothyroidism, medication)** • **Note: Galactorrhea without elevated prolactin, imaging is not indicated** • **Central Diabetes Insipidus (low ADH)** • **Precocious puberty in a child (male < 9; female < 8), with hormonal studies suggesting a central cause and evidence of an accelerated bone age on X-ray** • **Pituitary apoplexy with sudden onset of neurological and hormonal symptoms** • **Suspected recurrence with prior history of CNS cancer based on neurological symptoms or examination** **Added:** • **Follow up of known meningioma** o **If <2cm or heavily calcified at 2 years and 5 years** o **> 2cm annually for 3 years and then scans at 5 years and 10 years.** o **Multiple meningiomas, annually** o **After treatment (surgery or radiotherapy), post-operative if concern for residual tumor, every 6-12 months then annually for 3-5 years based on WHO Grade (see background)** • **Follow-up known of pituitary adenoma** o **New signs or symptoms** o **Functioning adenoma - to assess response to treatment and 1-year follow-up after drug holiday** **Added:** • **Follow of known pineal cyst (≥ 5mm) if there are atypical features or symptoms (e.g., headaches, gaze paresis, ataxia, papilledema, nausea/vomiting)**

	• **Follow of known arachnoid cyst**
	  o **< 4 years old, serial imaging is warranted**
	  o **> 4 years old, repeat imaging is approvable if newly symptomatic i.e. headaches, increased intracranial pressure, hydrocephalus, local mass effect, seizures, visual/endocrine dysfunction**
	• **For screening for known Non-CNS Cancer**
	  o **Default screening for**
	  ▪ **Kidney cancer**
	  ▪ **Lung cancer**
	  ▪ **Merkel cell carcinoma**
	Added:
	• **Mucosal melanoma of the head and neck, especially of the oral cavity**
	• **Poorly differential neuroendocrine cancer (Large or Small cell/Unknown primary of neuroendocrine origin)**
	• **Screening with preconditions**
	  o **AML…….Suspicion of leukemic meningitis**
	  o **Cutaneous melanoma….Stage IIIC or higher**
	  o **Testicular Cancer-Seminoma….. High risk**
	  o **Gestational Trophoblastic Neoplasia…Pulmonary metastasis**
	  o **Bladder cancer……High risk, i.e. small cell**
	• **All other cancer if CNS symptoms present**
	Added:
	• **For screening of Hereditary Cancer Syndromes**
	  o **Li Fraumeni syndrome- Annually**
	  o **Von Hippel Lindau – Every 2 years, starting at age of 8 years**
	  o **Tuberous Sclerosis – Every 1-3 years, until the age of 25 years**
	  o **MEN1 – Every 3-5 years, starting at the age of 5 years**
	  o **NF-2- Brain IAC: Annually starting, from age of 10 years**
	  o **Sturge Weber Syndrome: Once, after age 1 to rule out intracranial involvement after; in patients <1 year, only if symptomatic**
	• **Known seizure disorder without previous imaging**
	Added:
	• **Imaging indications for new onset seizures in the pediatric population**
	  o **Abnormal neurological exam, especially a postictal focal deficit**
	  o **Significant developmental delay**

	o **Focal onset** o **EEG shows focal or suspected structural abnormalities** o **<1 year of age** **Note: Imaging is not indicated in simple febrile seizures** • **Suspected temporal arteritis in a patient > 50 with temporal headache, abrupt visual changes, jaw claudication, temporal artery tenderness, constitutional symptoms or elevated ESR AND** o **Negative initial work-up (color Doppler ultrasonography or biopsy) OR** o **Atypical features or failure to response to treatment with concern for large vessel involvement** **Added:** • **MRI indicted for atypical dystonia. Note: MRI not indicated in essential tremor or isolated focal dystonia (e.g., blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia)** • **Binocular diplopia with concern for intracranial pathology** • **Hemifacial spasm** • **Other objective cranial nerve palsy (CN IX-XII)** • **Follow up shunt evaluation (Pople, 2002, Reddy, 2014, Kamenova, 2018)** o **Post operatively if indicated based on underlying disease and pre-operative radiographic findings and/or** o **6-12 months after placement and/or** o **With neurologic symptoms that suggest shunt malfunction** **Added:** • **Suspected spontaneous intra-cranial hypotension with distinct postural headache other symptoms include: nausea, vomiting, dizziness, tinnitus, diplopia neck pain or imbalance** • **CSF flow study for evaluation and management of CSF flow disorders** • **Diagnosis of central sleep apnea on polysomnogram** o **Children > 1 year** o **Adults in the absence of heart failure, chronic opioid use, high altitude, or treatment emergent central sleep apnea AND concern for a central neurological cause (Chiari malformation, tumor, infectious/inflammatory disease) OR with an abnormal neurological exam** • **Syncope with clinical concern for seizure or associated neurological signs or symptoms**

	• **Cyclical vomiting syndrome or abdominal migraine with any localizing neurological symptoms** • **Soft tissue mass of the head with nondiagnostic initial evaluation (ultrasound and/or radiograph)** **Added:** • **Cerebral palsy if etiology has not been established the neonatal period, there is change in the expected clinical or developmental profile or concern for progressive neurological disorder** • **Unexplained event (BRUE) formerly apparent life-threatening event (ALTE) in infants < 1 year with concern for neurological cause based on history and exam** **Note: Imaging is not indicated in low risk patients** • **Under Indications for a Brain MRI with Internal Auditory Canal (IAC):** o **CSF otorrhea (MRI for intermittent leak, CT for active leaks)** o **Clinical Suspicion of acute mastoiditis as a complication of acute otitis media with intracranial complications (i.e. meningeal signs, cranial nerve deficits, focal neurological findings, altered mental status)** o **Bell's Palsy for evaluation of the extracranial nerve course - if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset** **Added:** • **Combo Brain MRI/MRA** o **Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up** ▪ **Negative Brain CT;** ▪ **AND Negative Lumbar Puncture** ▪ **Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm** • **Combo Brain MRI/Orbit MRI** o **Optic Neuritis if atypical presentation, severe visual impairment or poor recovery following initial onset or treatment onset** • **Combo Brain MRI/Face/Sinus/Neck MRI** o **Bells/hemifacial spasm that meets above criteria**

	○ **Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course** ○ **Granulomatosis with polyangiitis (Wegener's granulomatosis) disease** **Deleted:** • **Under New onset of headache and any of the following** ○ **Temporal headache in person > 55, with sedimentation rate (ESR) > 55 with tenderness over the temporal artery.** • **Known or suspected pituitary tumor with corroborating physical exam (i.e., galactorrhea or acromegaly) neurologic findings and/or lab abnormalities.** • **Known brain tumor and new onset of headache.** • **Follow up shunt evaluation within six (6) months of placement or one (1) year follow up and/or with neurologic symptoms** • **From combo Brain MRI/MRA Clinical suspicion of subarachnoid hemorrhage (SAH) ie thunderclap headache**
August 2019	• **For evaluation of patient with neurologic symptoms or deficits suspicious for MS: Added: "clinically isolated syndrome OR recurrent episodes of variable neurological signs or symptoms not attributable to another cause; And Removed time frame of 'within the last 4 weeks'** • **Removed: Stable condition with no prior imaging within the past ten (10) months or within the past six (6) months if patient has relapsing disease** • **Removed: Exacerbation of symptoms or change in symptom characteristics such as frequency or type and demonstrated compliance with medical therapy.** • **For evaluation of MS, added:** ○ **To establish a new baseline (no recent imaging, postpartum, or 6-12 months after switching disease modifying therapy)** ○ **Prior to starting or switching disease-modifying therapy** ○ **Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years** ○ **New signs or symptoms suggested of an exacerbation or unexpected clinical worsening** ○ **PML surveillance for patients on natalizumab** • **For evaluation of known or suspected seizure disorder, added:** ○ **Newly identified change in seizure activity/pattern**

	• **Renamed Parkinson's section to: Movement disorders and added:**
	  o **For the evaluation of other movement disorder to exclude a structural lesion (i.e., suspected Huntington disease, chorea, atypical parkinsonian syndromes, hemiballismus, secondary dystonia).**
	  o *** MRI not indicated in essential tremor or primary dystonia**
	  o **For suspected Parkinson's, added 'with atypical feature or unresponsive to levodopa**
	• **For evaluation of neurologic symptoms or deficits, added: visual loss**
	• **For trauma, added:**
	  o **On anticoagulation**
	  o **Post concussive syndrome if persistent or disabling symptoms and imaging has not been performed**
	  o **Subacute or chronic traumatic brain injury with new cognitive and/or neurologic deficit**
	• **For evaluation of headache, added or removed:**
	  o **Prior history of stroke or intracranial bleed with sudden onset of severe headache (moved)**
	  o **New headache and signs of increased intracranial pressure**
	  o **Related to activity or event (sexual activity, exertion, position) (new or progressively worsening)**
	  o **New headache and persistent or progressively worsening during a course of physician directed treatment**
	  o **Special considerations in the pediatric population with persistent headache:**
	  ▪ **Occipital location**
	  ▪ **Age < 6 years**
	  ▪ **No family history of headache**
	• **For evaluation of brain tumor:**
	  o **Specified 'malignant' for f/u of known tumor**
	  o **Added: Follow up of known benign tumor if symptomatic, new/changing signs or symptoms or complicating factors; Follow up of known meningioma; and tumor evaluation and monitoring in neurocutaneous syndromes**
	  o **Removed: Known lung cancer or rule out metastasis and/or preoperative evaluation, Metastatic melanoma (not all melanomas)**
	• **For evaluation of suspected stroke:**
	  o **Moved 'patient with history of a known stroke with new and sudden onset of severe headache'**

	o **Separated: Family history of aneurysm** • **For evaluation inflammatory disease or infections:** o **Changed meningitis with positive signs and symptoms from 'And' positive lab findings to 'OR' positive labs** o **For suspected encephalitis removed 'severe' headache** • **For evaluation of congenital abnormality:** o **Modified the age restriction of > 6 months age for eval of macrocephaly to include 'in an infant/child with previously abnormal US, abnormal neurodevelopmental exam, signs of increased ICP or closed anterior fontanelle'** • **For known or suspected normal pressure hydrocephalus (NPH):** o **Added - With symptoms of gait difficulty, cognitive disturbance and urinary incontinence** • **Other Indications:** o **Added detail to Vertigo including:** ▪ **Signs or symptoms suggestive of a CNS lesion (ataxia, visual loss, double vision, weakness or a change in sensation)** ▪ **Progressive unilateral hearing loss** ▪ **Risk factors for cerebrovascular disease** ▪ **After full neurologic examination and ENT work-up with concern for central vertigo** o **Modified developmental delay to include: Global developmental delay or developmental delay with abnormal neurological examination** o **Added:** ▪ **Horner's syndrome with symptoms localizing the lesion to the central nervous system** ▪ **Trigeminal Neuralgia – if <40 years of age or atypical features (ie bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain >2min, pain outside trigeminal nerve distribution, progression)** ▪ **Bell's Palsy- if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset.** ▪ **Psychological changes with neurological deficits on exam or after completion of a full neurological assessment that suggests a possible neurologic cause** ▪ **New onset anisocoria** o **Removed Objective cranial nerve palsy; and Cholesteatoma (duplicated)**

	• **For Brain MRI/Neck MRA: deleted 'confirmed carotid occlusion > 60%, surgery or angioplasty candidate' and added 'Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits'** • **Added Brain MRI/Brain MRA section, including: Clinical suspicion of subarachnoid hemorrhage (SAH) ie thunderclap headache; and Suspected venous thrombosis (dural sinus thrombosis)** • **Added Brain MRI/Brain MRA/Neck MRA section, including: Recent stroke or transient ischemic attack (TIA); and Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent vascular and intracranial pathology** • **For Brain MRI/Cervical MRI, added: Suspected MS with new or changing symptoms consistent with cervical spinal cord disease; and Follow up to the initiation or change in medication for patient with known Multiple Sclerosis** • **For Brain MRI/Orbit MRI, added: Bilateral papilledema with visual loss; and Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent or bilateral optic neuritis; AND changed age restriction from 3 years to 8 years for children requiring anesthesia for the procedure with suspicion of concurrent orbital and intracranial pathology or tumor** • **Added section for Brain MRI/Face/Sinus/Neck MRI, including: Anosmia on objective testing; and Trigeminal neuralgia or cranial nerve palsy that meets the above criteria** • **Updated background information and references**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **ABDOMEN MRI** **MRCP (Magnetic Resonance Cholangiopancreatography)**	**Original Date: September 1997**
CPT Codes: 74181, 74182, 74183, S8037, +0698T	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_031	**Implementation Date: January 2022**

IMPORTANT NOTE: A single authorization for CPT code 74181, 74182, 74183, S8037 includes imaging of the biliary tree and liver. Multiple authorizations are not required. When a separate MRCP and MRI abdomen exam is requested, documentation requires a medical reason that clearly indicates why additional MRI imaging of the abdomen is needed.

Note: There is no MRI Abdomen/Pelvis combo (comparable to a CT Abdomen/Pelvis) such that if imaging of both the abdomen and pelvis are indicated, two separate exams (and authorization) are required (i.e., MRI Abdomen and MRI Pelvis)

This study includes MRU (MR urography) and MRE (MR enterography).

INDICATIONS FOR ABDOMEN MRI

Evaluation of suspicious known mass/tumors for further evaluation of indeterminate or questionable findings

- Initial evaluation of suspicious abdomen masses/tumors found only in the abdomen by physical exam or imaging study, such as ultrasound (US), or CT (ACR, 2019).
- Follow-up of known cancer (Bourgioti, 2016; NCCN, 2019):
    - Follow-up of known cancer of patient undergoing active treatment within the past year
    - **Known cancer with suspected abdominal/pelvic metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)**
    - **For known prostate cancer abdomen MRI can be approved when requested in combination with pelvis MRI when meets GL for pelvis MRI**

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

For evaluation of an organ or abnormality seen on previous imaging

ADRENAL

- To locate a pheochromocytoma once there is clear biochemical evidence **(See Background)** (Lenders, 2014)
- Suspected adrenal secreting tumor after full clinical and biochemical work-up (Fassanacht, 2018; Meek, 2013)
- Suspected adrenal mass ≥ 1 cm incidentally discovered with no history of malignancy (one follow-up in 6 – 12 months to document stability)
- If adrenal mass ≥ 4 cm and no diagnosis of cancer, can approve for preoperative planning (surgery to rule out adrenal cortical carcinoma)
- For adrenal mass < 4 cm with history of malignancy (if ≥ 4 cm consider biopsy or FDG-PET/CT unless pheochromocytoma is suspected)
- Yearly surveillance for patients with Multiple Endocrine Neoplasia type 1 (MEN1) beginning at age 10 (Kamilaris, 2019)
- For patients with Von Hippel Lindau (VHL) surveillance at least every other year starting at age 16 (abdominal ultrasound starting at age 8) (Varshney, 2017)
- Surveillance MRI (include pelvis) every 2-3 years for patients with Hereditary Paraganglioma syndromes types 1-5 (Benn, 2015)

LIVER

- Indeterminate liver lesion ≥ 1cm seen on prior imaging (ACR, 2020)
- Indeterminate liver lesion < 1cm on initial imaging, with known history of extrahepatic malignancy, or known chronic liver disease
- Hepatitis/hepatoma screening after ultrasound is abnormal, equivocal, or non-diagnostic (may be limited in patients who are obese, those with underlying hepatic steatosis, as well as nodular livers (ACR, 2017; Bruix, 2011; Lee, 2014; Marquardt, 2016)). **(No literature supports the use of AFP alone in the screening of HCC).**
- **For jaundice or abnormal liver function tests after equivocal or abnormal ultrasound (Vagvala, 2018)**
- For surveillance of HCC in patients who have received liver-directed therapy, surgical resection, medical treatment, or transplant (MRI or CT) at one-month post treatment and then every 3 months for up to two years **(See Background)** (Arif-Tawari, 2017; **Vagvala, 2018**)
- For follow-up of suspected adenoma every 6-12 months
- For surveillance of patients with primary sclerosing cholangitis (also CA 19-9), every 6-12 months after the age of 20 (MRI and MRCP preferred over CT) (Bowlus, 2019)
- For follow up of focal nodular hyperplasia (FNH) annually if US is inconclusive (Marrero, 2014)
- For elastography in chronic liver disease to stage hepatic fibrosis (ACR, 2019)
- In patients with Beckwith-Wiedemann syndrome and abnormal ultrasound or rising AFP (Kalish, 2017)

Evaluation of iron overload in the following settings

- Initial evaluation of liver iron in Hemochromatosis diagnosed in lieu of liver biopsy (Labranche, 2018)
- Annual evaluation for **high**-risk patients: transfusion-dependent thalassemia major, sickle cell disease and other congenital anemias (Wood, 2014)

PANCREAS

- Pancreatic cystic lesion found on initial imaging
- For **follow**-up of known intraductal papillary mucinous neoplasm (IPMN) and mucinous cystic neoplasm (MCN) (if there are no high-risk characteristics, **see Background section**) (Elta, 2018):
    - For incidental and asymptomatic cysts <5 mm, one follow-up at three years (Pandey, 2019)
    - For cysts 5mm-1cm image every 2 years for 4 years, and if stable may lengthen intervals
    - For cysts 1-2cm image every year for 3 years and if stable every 2 years for 4 years, and if stable may lengthen intervals
    - **C**ysts that are 2-3 cm followed every 6-12 months for 3 years and if stable then yearly for 4 years and if stable may lengthen intervals (can also use EUS-Endoscopic ultrasound)
    - For lesions ≥ 30 mm MRI/CT or EUS every 6 months for 3 years, then imaging alternating with EUS every year for 4 years and consider lengthening interval if stable
- **Annual surveillance** for individuals determined to have an increased lifetime risk of developing pancreatic cancer, based on genetic predisposition or family history
    - Starting at age 50 or 10 years younger than the earliest age of cancer affected **first-**degree relative (except with Peutz-Jeghers start at age 30-35)
    - Von Hippel Lindau starting at age 16 at least every other year (abdominal ultrasound starting at age 8)
    - Hereditary Pancreatitis starting at age 40 or 20 years before first attack** (Hu, 2018; NCCN, 2019; Syngal, 2015)
    - For other approvable genetic syndromes that increase lifetime risks, see **background section**
- Annual surveillance for patients with MEN1 for primary neuroectodermal tumors (pNET) starting at age 10 (EUS also considered)
- For localization of an insulinoma, once diagnosis is confirmed (CT preferred) (Vinik, 2017)

RENAL

- For an indeterminate renal mass on other imaging (ACR, 2014)
- Active surveillance for indeterminate cystic renal mass, not a simple renal cyst (Richard, 2017) (See **Bosniak criteria** in **Background** section).
- Follow-up for solid renal masses under 1 cm at 6 and 12 months, then annually (Herts, 2018)
- Annual surveillance for patient with tuberous sclerosis and known angiomyolipomas (Vos, 2018)
- For surveillance of patients with Von Hippel Lindau at least every other year to assess for clear cell renal cell carcinoma to begin at age 16 (screening with ultrasound starting at around age 8) (Varshney, 2017)
- Active surveillance for renal cell carcinoma in patients with Birt-Hogg syndrome every 36 months (Gupta, 2017)

- MRU (may also approve MR pelvis for MR urography) **when ultrasound is inconclusive and CT (CTU) cannot be done or is inconclusive and MRI is recommended**

SPLEEN
- Incidental findings of the spleen on ultrasound or CT that are indeterminate (Thut, 2017)

Suspected Hernia
- Occult, spigelian, incisional or epiastric hernia when physical exam **and** prior imaging (ultrasound AND CT) is non-diagnostic or equivocal (Ab**d**elmohsen, 2017; Lassandro, 2011; Miller, 2014; Robinson, 2013) and limited to the abdomen
- Suspected incarceration or strangulation based on physical exam or prior imaging (CT preferred) (Halligan, 2018)

For evaluation of suspected infection or for follow-up known infection (may approve in conjunction with Pelvis MRI when indicated)
- Persistent abdominal pain not explained by previous imaging/procedure
- Any known infection that is clinically suspected to have created an abscess in the abdomen
- Any history of fistula limited to the abdomen that requires re-evaluation or is suspected to have recurred
- Abnormal fluid collection limited to the abdomen seen on prior imaging that needs follow-up evaluation
- Suspected peritonitis (from any cause**)(would typically need to include MRI Pelvis)** abdominal pain and tenderness to palpation is present, and **at LEAST one** of the following:
    - Rebound, guarding or rigid abdomen, **OR**
    - Severe tenderness to palpation over the entire abdomen
- Complications of diverticulitis with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment (prior imaging study is not required for diverticulitis diagnosis (Cartwright, 2015)

For evaluation of suspected inflammatory bowel disease or follow-up known disease (includes MR enterography and can also approve Pelvis MRI/MRE)
- **For suspected inflammatory bowel disease (Crohn's disease or ulcerative colitis) with abdominal pain AND one of the following (ACR, 2019; Arif-Tiwari, 2019; Lichtenstein, 2018):**
    - **Chronic diarrhea**
    - **Bloody diarrhea**
- **High clinical suspicion after complete work up including physical exam, labs, endoscopy with biopsy (ACR, 2019; Arif-Tiwari, 2019; Lichtenstein, 2018; Rubin, 2019)**
- For MR enterography (MRE) if CT or MRI of the abdomen and pelvis are inconclusive
- Known inflammatory bowel disease (Crohn's or ulcerative colitis) with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy (ACR, 2019)

Other indications for abdominal MRI (and pelvis where appropriate) when CT is inconclusive or cannot be completed

- Persistent abdominal/pelvic pain not explained by previous imaging
- To locate a pheochromocytoma once there is clear biochemical evidence **(See Background)**
- For B symptoms of fevers more than 101 F, drenching night sweats, and unexplained weight loss of more than 10% of body weight over 6 months, if CXR labs and an ultrasound of the abdomen and pelvis have been completed (Cheson, 2014)
- Unexplained weight loss of 10% of body weight in two months (patient history is acceptable); with second MD visit documenting further decline in weight (Gaddey, 2014)
- Unexplained weight loss of 5% of body weight in six months confirmed by documentation to include the following (Bosch, 2017; Wong, 2014):
    - Related history and abdominal exam
    - CXR
    - Abdominal ultrasound
    - Lab tests, including TSH
    - Colonoscopy if 50-85 years old
- For fever of unknown origin (temperature of ≥ 101 degrees for a minimum of 3 weeks) after standard diagnostic tests are negative (Brown, 2019)
- For suspected or known retroperitoneal fibrosis after complete workup and ultrasound to determine extent of disease (Runowska, 2016)
- To screen patients with dermatomyositis for occult malignancy (Titulauer, 2011)
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound (Hoshino, 2016)
- For suspected May-Thurner syndrome (CTV/MRV preferred) (Ibrahim, 2012; Wu, 2012)
- For further evaluation of an isolated right varicocele with additional signs and symptoms that suggest malignancy or suspicious prior imaging findings (Gleason, 2019)

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

INDICATIONS FOR MRCP

(ACR, 2019; Akisik, 2013; Lindor, 2015)

- To confirm choledocholithiasis in patients in the acute setting after ultrasound has been completed (ACR, 2019; Buxbaum, 2019; Williams, 2017)
- Suspected acute pancreatitis with atypical signs and symptoms, including equivocal amylase and lipase and diagnosis other than pancreatitis may be possible. (MRCP and CT may be ordered simultaneously in this setting and may be approved) (ACR 2019; Mathur, 2015)
- Pancreatitis by history (greater than 4 weeks), (including pancreatic pseudocyst) with continued abdominal pain suspicious for worsening, or re-exacerbation. (MRCP and CT may be ordered simultaneously in this setting and may be approved) (ACR 2019; Mathur, 2015)
- Evaluation of suspected congenital anomaly of the pancreaticobiliary tract, e.g., aberrant ducts, pancreas divisum or related complications (Griffin, 2012)

- For confirmation of choledochal cyst after ultrasound has been done (Katabathina, 201**4**)
- For long-term postoperative surveillance for patients with history of choledochal cyst
- For post-surgical biliary anatomy and complications when ERCP is not possible or contraindicated
- For the assessment of benign or malignant biliary strictures
- Evaluation of persistent symptoms when abnormalities are identified on other imaging (e.g., ultrasound, CT, or MRI)
- Evaluation of abnormality related to the pancreatic or biliary tree based on symptoms or laboratory findings and initial imaging has been performed or is contraindicated (e.g., renal failure prevents contrast CT or body habitus limits US)
- Evaluation of pancreatobiliary disease in pregnant patients after ultrasound has been done

INDICATIONS RELEVANT TO ABDOMEN MRI OR MRCP

Pre-operative evaluation
- For abdominal surgery or procedure

Post-operative/procedural evaluation
- Follow-up of known or suspected post-operative complication involving only the abdomen
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

If both Abdomen and Pelvis MRI are indicated and the Pelvis MRI has already been approved, then the Abdomen MRI may be approved.

BACKGROUND

***Abdominal Magnetic Resonance Imaging (MRI)** is a proven and useful tool for the diagnosis, evaluation, assessment of severity, and follow-up of diseases of the abdomen and avoids exposing the patient to ionizing radiation. MRI may be the best imaging procedure for patients with allergy to radiographic contrast material or renal failure. It may also be the procedure of choice for suspected lesions that require a technique to detect subtle soft-tissue contrast and provide a three dimensional depiction of a lesion. Abdominal MRI studies are usually targeted for further evaluation of indeterminate or questionable findings, identified on more standard imaging exams such as **u**ltrasound (US) and CT.

Magnetic Resonance Enterography is an excellent study for assessing submucosal pathology in inflammatory bowel disease. It generates highly reproducible images of the large and small bowel with excellent sensitivity and specificity. It can determine the presence and extent of transmural inflammation, fibrotic disease, and other intra-abdominal complications. It is also useful in assessment of bowel obstruction, abscess formation, tethering and fistula and is less dependent on bowel distention than CT enterography (Arif-Tiwari, 2019).

Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive radiologic technique for imaging the biliary and pancreatic ducts in the clinical setting of cholestatic liver function tests, right upper quadrant pain, recurrent pancreatitis, and assessing postoperative complications. MRCP is reliable for the diagnosis of pancreatic ductal abnormalities, e.g., pancreas divisum. It is also used to diagnose bile duct stones and assess the level of biliary obstruction. MRCP is especially useful as an alternative to ERCP (Endoscopic retrograde cholangiopancreatography) when a noninvasive exam is desired or when there is a very small likelihood that the patient will need therapeutic intervention afforded by ERCP. MRCP is unwarranted in patients with known pathology requiring **ERCP**-mediated intervention. Due to the variable accuracy of ultrasound in detecting choledocholithiasis, preoperative MRCP prior to cholecystectomy has been advocated particularly in the setting of acute cholecystitis, near normal common bile duct diameter (where ultrasound is less accurate) and elevated liver functions, especially alanine amino transaminase (ALT) (Qiu, 2015). Secretin-enhanced MR Cholangiopancreatography has been recently developed to improve the diagnostic quality of MRCP images (Tirkes, 2013).

In diagnosing acute pancreatitis, MRI and MRCP are not as practical as CT. The latter can be performed more quickly and provide better images due to less motion artifact (if patient cannot cooperate with instructions for MRI) in acutely ill patients (ACR, 2019). In selected patients, however, such as those who cannot receive iodinated contrast for CT, MRI/MRCP may be considered or used in a complementary fashion to CT. Complications of chronic pancreatitis using MRCP are **well**-imaged in cooperative patients.

Cross-sectional imaging (liver ultrasound with Doppler, CT or MRI) should be completed no more than a month prior to the Transjugular intrahepatic Portosystemic shunt (TIPS) to assess for vascular patency and look for hepatic masses or other problems that could complicate the procedure.

Post procedure, an ultrasound of the liver **is performed** a day after to assess shunt patency. Hepatic encephalopathy (HE) is the most common complication and usually occurs 2-3 weeks after insertion of TIPS. Unique complications may include intravascular hemolysis and infection of the shunt. Other complications, **which may require cross-sectional imaging**, can include capsule puncture, intraperitoneal bleed, hepatic infarction, fistula, hematobilia, thrombosis of stent, occlusion, or stent migration.

Follow-up and maintenance imaging, if complications **are** suspected, include Doppler ultrasound to assess shunt velocity. If asymptomatic, **a** sonogram **is** performed at 4 weeks post placement, then every 6 months to a year. The gold standard for shunt patency is portal venography, usually reserved if concern for shunt occlusion.

OVERVIEW

MRI of the liver – The liver is a common site of metastatic spread. Patients with a history of known or suspected malignancy, especially tumors from the colon, lung, pancreas and stomach, are at risk for developing hepatocellular carcinoma. Patients with chronic liver disease are also at risk for developing liver cancer and undergo periodic liver screening for focal liver lesion detection, usually with ultrasonography (US). Extra-cellular gadolinium chelate contrast-enhanced MRI is used for evaluating

patients with an abnormal US. Patients with hepatic metastases being considered for metastasectomy undergo contrast-enhanced MRI using tissue-specific contrast agents.

Screening for Hepatocellular carcinoma (HCC): AASLD (American Association for the Study of Liver Diseases) recommends screening for HCC with ultrasound every 6 months for patients with hepatitis C and B (Bruix, 2011). The literature differs on the role of AFP (alpha fetoprotein) in the screening of HCC. Some authors argue against its use altogether due to its lack of sensitivity and specificity in detecting HCC (Bruix, 2011; Marquardt, 2016) and instead recommend ultrasound alone for screening. According to Marquardt, the AASLD and EASLD (European Association for the Study of the Liver) "do not endorse its [AFP] use in clinical routine, neither alone nor in combination with ultrasound". This approach is supported by reports of patients with chronic viral hepatitis and elevated AFP but normal livers on imaging. AFP elevation in these cases is due to hepatic inflammation and viral replication (Patil, 2013), not neoplasm. Others advocate for combined ultrasound and AFP for screening (Tan, 2011; Tzartzeva, 2018) citing increased sensitivity compared to ultrasound alone in detecting early-stage HCC particularly in cirrhotic patients. In a meta-analysis by Tzartzeva, et al of thirty-two studies (13,367 patients with cirrhosis) ultrasound with AFP had a 63% sensitivity of detecting early-stage HCC compared to 45% for ultrasound alone. In the final analysis, no literature supports the use of AFP alone in the screening of HCC.

MRI or MRCP for surveillance of cholangiocarcinoma in patients with PSC, other risk factors: Cholangiocarcinoma, **a cancer with an increase in incidence globally**, is very aggressive with 95% of patients dying within 5 years. Because of the superior sensitivity of MRI compared with ultrasound to detect cholangiocarcinoma, it is preferred for imaging surveillance. In a large study of PSC patients, regular surveillance was associated with a higher 5-year survival (Bowlus, 2019).

The strongest risk factors for both intrahepatic **(iCCA**) and extrahepatic **(eCCA**) cholangiocarcinoma are choledochal cysts; cirrhosis **is a stronger risk factor** for iCCA **(i.e., iCCA**>eCCA); and choledocholithiasis **is a stronger risk factor** for **eCCA (i.e., eCCA**>iCCA) (Clements, 2020).

MRI of the adrenal glands – The adrenal glands are susceptible for metastases from various tumors, especially of lung or breast. Adrenal lesions may also represent primary tumors of the adrenal cortex of medulla, both benign and malignant. MRI may be done to distinguish between benign and malignant lesions. Metastases are predominantly hypointense on T1-weighted images and hyperintense on T2-weighted images. Benign lesions, which have high lipid content, exhibit a drop in signal intensity on opposed phase chemical shift imaging.

In general, masses found < 1 cm do not need to be pursued. If an adrenal mass has diagnostic features of a benign mass, such as a myelolipoma (presence of macroscopic fat), cyst, or hemorrhage (masses without enhancement, defined as change in pre- and postcontrast imaging of <10 HU), no additional workup or follow-up imaging is needed. If the mass has a density of 10 HU on unenhanced CT or signal loss compared with the spleen between in- and opposed-phase images of a chemical-shift MRI (CS-MRI) examination, these features are almost always diagnostic of a lipid-rich adenoma, regardless of size. If no benign imaging features but stable for a year or longer, **it is** very likely benign and needs no

further imaging. The role of adrenal mass biopsy is reserved predominantly to confirm a suspected adrenal metastasis; this procedure has been shown to be safe with a low morbidity.

If there are signs or symptoms of pheochromocytoma, **plasma**-free metanephrine and normetanephrine levels or urinary fractionated metanephrines should be obtained prior to biopsy. Imaging **is** recommended with CT (MRI as second option) once biochemical evidence confirmed. Otherwise, endocrine workup of an incidental adrenal mass is controversial. Current guidelines from the American Association of Clinical Endocrinologists and the American Association of Endocrine Surgeons recommend an initial biochemical evaluation of all adrenal incidentalomas to exclude pheochromocytoma, subclinical Cushing's syndrome, and hyperaldosteronism.

Genetic syndromes and adrenal tumors - Adrenal cortical carcinoma (ACC) diagnosed during childhood is known to be commonly associated with hereditary syndromes, including Beckwith-Wiedemann (BWS) and Li-Fraumeni syndrome (LFS). In adults, ACC may be associated with Multiple Endocrine Neoplasia 1 (MEN1), familial adenomatous polyposis coli and neurofibromatosis type 1 (NF1); however, there are currently no surveillance imaging recommendations (Tobias, 2012).

MRI of the pancreas – Pancreatic cancer is thought to have a familial or hereditary component in approximately 10% of cases. Surveillance of individuals with genetic predisposition for pancreatic adenocarcinoma should include known mutation carriers from hereditary syndromes, such as Peutz-Jeghers (10-30% lifetime risk), hereditary pancreatitis (which is associated with genes *PRSS1* and *SPINK1*), familial atypical multiple melanoma and mole syndrome (10-30% risk) or for members of familial pancreatic cancer with a first-degree family member with pancreatic cancer. In patients who are mutation carriers in *BRCA2* (5-10% lifetime risk), *PALB2* (5-10% lifetime risk), and Lynch syndrome (5-10%) families. Surveillance for patients with *BRCA1* (2% lifetime risk) and *ATM* serine/threonine kinase (1-5% lifetime risk) is limited to those with first- or second-degree relatives with pancreatic cancer. NCCN also recommends screening for individuals with a known pathogenic/likely pathogenic germline variant in a pancreatic susceptibility gene, including *CDKN2A, MLH1, MLH2, MSH6, PMS2, EPCAM* (mismatch repair genes associated with Lynch syndrome), *ATM, PALB2, STK11, TP-53* and a family history (first- or **second**-degree relative) from the same side of the family; or a family history of exocrine pancreatic cancer in ≥2 first-degree relatives from the same side of the family or ≥3 first- and second-degree relatives from the same side of the family (and at least one is a first-degree relative) (Daly, 2020; Goggins, 2020; NCCN, 2019).

Patients with a family history of pancreatic cancer affecting two first-degree relatives meet criteria for familial pancreatic cancer and are candidates for genetic testing. It should be noted that 90% of families meeting criteria for familial pancreatic cancer will not have a pathogenic mutation (Stoffel, 2019).

Surveillance of Pancreatic Cysts: Some pancreatic cysts have the potential for malignant transformation to invasive ductal adenocarcinoma; hence the need for intervention vs surveillance. The data, **however**, is unclear as to the risk of cancer. Cyst surveillance can be offered to patients with asymptomatic cysts presumed to be IPMNs or MCNs. Pancreatic cystic Neoplasms (PCN) make up about 2-45% of the general population.

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct calib**er** with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations (Elta, 2018).

MRI and insulinoma-Insulinomas are rare pancreatic tumors. Localization of the tumor by ultrasound or CT are the preferred initial options once a diagnosis has been made, followed by endoscopic ultrasound or arterial stimulation with hepatic venous sampling. Whipples triad includes symptoms of hypoglycemia, low blood glucose relieved by ingestion of glucose, and benign 90%. Work-up prior to imaging should include a 72-hour fast with serial glucose and insulin levels over this period until the patient becomes symptomatic. An insulin/glucose ratio of greater than 0.3 has been found in virtually all patients with insulinoma or other islet cell tumors (Vinik, 2017).

MRI and elevated Liver Function Tests: For elevated bilirubin or serum transaminases with or without bilirubin elevation, US is the initial recommended test to assess for duct dil**a**tation which might lead to ERCP or MRCP, vs other causes which might necessitate further lab testing or liver biopsy (Kwo, 2017).

MRI of the kidney – MRI in renal imaging has been used to differentiate benign lesions versus malignant lesions in patients unable to undergo CT scanning with contrast media or in cases where the CT findings were questionable. Initial evaluation of renal lesions is often undertaken with ultrasound. MRI can have additional diagnostic value in the evaluation of lesions with minimal amounts of fat or with intracellular fat. MRI may have a higher accuracy than CT in the evaluation of early lymph node spread. Although MRI of the kidney has not yet found broad clinical application, it may have an increasing role in the management of patients with renal disease.

Recommendations for follow up of a complex cystic renal mass are made using Bosniak criteria (Muglia, 2014):

- Bosniak I (water density 0-20 HU); no further follow-up
- Bosniak II (one or a few thin septations, small or fine calcifications, hyperdense cysts up to 3 cm); no further follow-up
- Bosniak IIF felt to be benign but too complex to be diagnosed with certainty; image at 6 and 12 months, then annually for 5 years if no progression
- Bosniak III thick-walled cystic lesions with wall or septal enhancement; resection favored vs conservative management and RFA in select cases (Richard, 2017)
- Bosniak IV malignant cystic renal mass with enhancing soft tissue components; resection favored; malignant until proven otherwise

MRI of the spleen – Among some radiologists, the spleen is considered a 'forgotten organ' although it is included and demonstrated on every abdominal CT and MRI. Malignant tumors of the spleen are rare; malignant lymphomas are the most common and are usually a manifestation of generalized lymphoma. Splenic metastases are predominantly hypointense on T1-weighted images and

hyperintense on T2-weighted images, and MRI is used for the detection of necrotic or hemorrhagic metastases.

MRI for the evaluation of vascular abnormalities such as renal artery stenosis and celiac/superior mesenteric artery stenosis (in chronic mesenteric ischemia) - Doppler Ultrasound, MRA, or CTA should be considered as the preferred imaging modalities.

Imaging of hernias: Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a **first**-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT (Robinson, 2013). According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…" (Miller, 2014). Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

Ultrasound: Ultrasound is the initial imaging technique used for screening suspected biliary or pancreatic disease, but it has limited ability to characterize abnormalities in the biliary and pancreatic ducts.

Endoscopic retrograde cholangiopancreatography (ERCP): ERCP can combine diagnosis with therapeutic intervention, e.g., removal of stones, but it is an invasive procedure that carries significant risk of complications, e.g., pancreatitis. ERCP is also technically challenging in patients with post-surgical biliary and/or surgical anastomoses.

POLICY HISTORY

Date	Summary
April 2021	**Updated for concordance w/CTA abdomen/pelvis**
May 2020	**MRCP:** • **Added to confirm choledocholithiasis in the acute setting after ultrasound completed** • **Suspected acute pancreatitis with atypical presentation and other diagnosis possible** • **To confirm choledochal cyst or long-term post op surveillance** • **For assessment of suspected biliary strictures** • **For post op anatomy when ERCP cannot be done** **MRI:** • **Adrenal-added suspected adrenal secreting tumor after full work up** • **Surveillance for paraganglioma syndromes** • **Surveillance primary sclerosing cholangitis** • **Elastography to stage hepatic fibrosis** • **Beckwidth Wiedemann after abnormal ultrasound**

	• **Revised guidelines for follow up of pancreatic cystic lesions/intraductal papillary mucinous neoplasm** • **Revised based on NCCN 2019 guidelines for increased lifetime risk of developing pancreatic cancer** • **Added surveillance for MEN 1** • **Added for localization of an insulinoma once dx confirmed** • **Added surveillance for VHL, renal and Birt-Hogg syndrome** • **Added MRU for recurrent UTI's in females** • **Added a separate section on hernias** • **Improved info on inflammatory bowel disease, MRE** • **Added imaging for monitoring therapy in IBD** • **Under other indications added: to locate a pheochromocytoma when clear biochemical evidence; FUO: retroperitoneal fibrosis; added dermatomyositis; added May Thurner; added isolated right varicocele (only with additional signs and symptoms)** • **Comments with new section on surveillance of cholangiocarcinoma, genetic syndromes and adrenal tumors, Pancreatic cancer risk factors, surveillance of panc cysts, Insulioma work up, and CT and elevated LFT's.**
May 2019	• **Created combo guideline by absorbing MRCP guideline within the Abdomen MRI** • **Added Note: "A single authorization for CPT code 74181, 74182, 74183, S8037 includes imaging of the biliary tree and liver. Multiple authorizations are not required. When a separate MRCP and MRI abdomen exam is requested, documentation requires a medical reason that clearly indicates why additional MRI imaging of the abdomen is needed".** • **Added indications for evaluation of an organ or abnormality seen on previous imaging; liver lesions; jaundice or abnormal liver function; follow up of suspected adenoma and focal nodular hyperplasia; surveillance of HCC in patients who have received liver-directed therapy/surgical resection/medical treatment or transplant; pancreatic cystic lesion; intraductal papillary mucinous neoplasm and mucinous cystic neoplasm; pancreatic cancer risk; known necrotizing pancreatitis; renal mass; and spleen** • **Changed size parameters for adrenal mass:** o **Old: Suspected adrenal mass > 4 cm and there is a history of primary malignancy** o **Revised: Suspected adrenal mass ≥ 1 cm with no history of malignancy; if mass ≥ 4 cm and no diagnosis of cancer, can**

	approve for preoperative planning; for mass < 4 cm with history of malignancy • **Added/modified Background information and updated references**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **LOWER EXTREMITY MRI** **(Foot, Ankle, Knee, Leg or Hip MRI)**	**Original Date: September 1997**
CPT Codes: 73718, 73719, 73720, 73721, 73722, 73723, +0698T	**Last Revised Date: May 2021**
Guideline Number: NIA_CG_057-4	**Implementation Date: January 2022**

INDICATIONS FOR LOWER EXTREMITY MRI (FOOT, ANKLE, KNEE, LEG or HIP)
(Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI

Joint specific provocative orthopedic examination
(Fox, 2018)
Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging (**see Table 1).**

- Ankle
  - **Unstable syndesmotic injury (high ankle injury)**
    - **With inconclusive stress xrays and a standing CT cannot be done**
    - **Can have positive fibular translation, squeeze or cotton test, but imaging may be needed to confirm diagnosis**
- Knee (**D**oral, 2018; Katz, 2013; Mohankumar, 2014; Slaughter, 2014; Smith, 2015**; Taljanovic**, 2019)
  - Joint instability or meniscal injury on exam, demonstrated with a positive
    - McMurray's
    - Thessaly
    - Apley's
    - Lachman's

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

        - Anterior or Posterior Drawer sign
        - Varus or valgus stress
        - Acute mechanical locking of the knee not due to guarding (Hussin, 2014)
- Hip
    - Anterior Impingement sign (labral tear)(Hananouchi, 2012; Naraghi, 2015; **Ross, 2018**)
    - Posterior Impingement sign (labral tear)(Groh, 2009)

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed (Katz, 2013; Mordecai, 2014) (does not apply to young children).

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician supervised exercise**) of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment
- Persistent hip mechanical symptoms including clicking, locking, catching, giving way or hip instability with a clinical suspicion of labral tear, with or without clinical findings suggestive of impingement (Groh, 2009; Mintz, 2017)

Ankle instability and suspected anterior talofibular ligament rupture (**anterior and posterior drawer tests) as a result of a sprain requires initial active conservative therapy (above) and x-ray**

Painful acquired or congenital flatfoot deformity in an adult, after x-ray completed

- After failure of active conservative therapy listed above (Abousayed, 2017; Thorpe, 2012)

Extremity Mass

- Mass or lesion after non-diagnostic x-ray or ultrasound (Murphey, 2018)
    - Baker's cyst should be initially evaluated with ultrasound
    - If superficial mass, then ultrasound is the initial study.
    - If deep mass, then x-ray is the initial study.

Known Cancer of the Extremity

(**Bestic, 2019**; Fitzgerald, 2015; Holzapfel, 2015; Kircher, 2012; NCCN, 2019)

- Cancer staging
- Cancer Restaging
- Signs or symptoms of recurrence

Infection of Bone or Joint

(Beaman, 2017; Dodwell, 2013, Glaudemans, 2019)

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling

        - Decreased range of motion
        - Fevers
    - Laboratory findings of infection include:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
        - **Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone or deep infection is suspected**
            - **Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell (Bowers, 2020)**
        - **Neuropathic foot with friable or discolored granulation tissue, foul odor, non-purulent discharge, and delayed wound healing (Pitocco, 2019)**

Osteonecrosis (e.g., Avascular Necrosis (AVN), Legg-Calve-Perthes Disease)
(Felten, 2019; Murphey, 2014)

- Abnormal x-ray
- Normal or Indeterminate X-rays, but symptomatic and high risk
    - Glucocorticosteroid use
    - Renal Transplant recipient
    - Alcohol abuse (Fukushima, 2010)
    - Sickle Cell Anemia (Wali, 2011)

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis) (Colebatch, 2013)

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging.
- **Initial** imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- **Follow-up to determine treatment efficacy of the following:**
    - **Early rheumatoid arthritis**
    - **Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory**

Trauma
Bone Fracture

- Suspected stress or insufficiency fracture with a negative initial x-ray (Bencardino, 2017; Sadineni, 2015):
    - If hips, then approve an immediate MRI
    - Suspicion of a hip fracture in a pregnant patient does not require an initial x-ray

    - If other parts of the extremities and repeat x-rays in 10-14 days are negative or nondiagnostic
    - If at high risk for a complete fracture with conservative therapy **(e.g., navicular bone),** then immediate MRI is warranted (Kellar, 2020)
- Suspected acute hip fracture with initial x-rays negative or non-diagnostic (Gill, 2013; **Ross, 2019**)
- Pathologic fracture on x-ray (Fayad, 2005)
- Intra articular fractures that may require surgery. (e.g., depressed tibial plateau fracture (Prat-Fabregat, 2017)
- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion, CT is the preferred study (Morshed, 2014)

Tendon or Muscle Rupture after X-Ray
(Garras, 2012; Peck, 2017; Rubin, 2012; Wilkins, 2012)
- Clinical suspicion based on mechanism of injury and physical findings

Suspected ACL Rupture - Acute knee injury with physical exam limited by pain and swelling with x-ray completed
(Cecava, 2018; Wheeless, 2018)
- Based on mechanism of injury, i.e., twisting, blunt force
- Normal x-ray:
    - Extreme pain, inability to stand, audible pop at time of injury, very swollen joint, leg numbness
- Abnormal x-ray:
    - Large joint effusion on x-ray knee effusion

Osteochondral lesions (defects, fractures, osteochondritis dissecans) and x-ray **completed**
(Mintz, 2017; Smith, 2012; **Taljanovic**, 201**9**; Van Dijk, 2010)
- Clinical suspicion based on mechanism of injury and physical findings

Foreign Body
(Laya, 2017)
- Indeterminate x-ray and ultrasound

Loose bodies or synovial chondromatosis seen on xray or ultrasound
- In the setting of joint pain (Rajani, 2016)

Hip Impingement (Femoroacetabular Impingement)
- With negative, equivocal, or non diagnostic x-rays (Mintz, 2017) (and imaging would change treatment – active conservative care or surgery are the two mainstays of treatment) (Kekatpure, 2017)
- To determine candidacy for hip preservation surgery (Li, 2016)

Known or suspected inflammatory myopathies: (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)
(Jia, 2017; Joyce, 2012)

- For diagnosis
- For biopsy planning

Peripheral Nerve Entrapment (e.g., tarsal tunnel, Morton's neuroma)
(Domkundwar, 2017; Dong, 2012; Donovan, 2010; Tos, 2015)

- Abnormal Electromyogram or Nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Pediatrics

- Painful flatfoot deformity with suspected tarsal coalition, not responsive to active conservative care (Bouchard, 2014).
- Slipped Capital Femoral Epiphysis with negative frog leg and AP x-rays of the hips but clinically suspected) (Hesper, 2017; Kamegaya, 2011; Peck, 2017)
    - Drehman sign
    - Limited internal rotation of the hip
    - Consider imaging the asymptomatic contralateral hip with a normal x-ray to detect early SCFE if prophylactic surgery is planned (Balch Samora, 2018)
- Chronic Recurrent Multifocal Osteomyelitis after initial work-up (labs and x-ray) (Roderick, 2016)
- Acute limp in a child 5 or less years old, concern for infection (initial x-rays not needed) (Safdar, 2018)
- There is no relevant literature regarding the use of MRI pelvis to the feet in the initial evaluation of acute limp with nonlocalized symptoms and no concern for infection.
- Osteoid Osteoma – MRI not usually done because x-ray and CT more accurate for diagnosis (Iyer, 2012)

Pre-operative/procedural evaluation

Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications.

- Joint prosthesis loosening or dysfunction, x-rays non-diagnostic (Fritz, 201**4, 2015)**
  Trendelenburg sign or other indication of muscle or nerve damage after recent hip surgery
-

Table 1: Positive Orthopedic Joint Tests, Lower Extremity

ANKLE

Fibular translation
Squeeze
Cotton
Thompson
Thumb squeeze test
Mulder click

HIP

KNEE

Anterior draw
Pivot Shift Test
Lachman
Posterior tibial Sag
Posterior Draw
McMurray's Test
Thessaly
Valgus stress
Varus stress
Ege

BACKGROUND

Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI **can** positively influence clinicians' diagnoses and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW

***Conservative Therapy:** (Musculoskeletal) 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, (**including** crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, **etc**. and not to include neoprene sleeves), medications, injections (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 chiropractic care.

****Home Exercise Program (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-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).

Joint Implants and Hardware - The presence of a metallic implant or metallic fixation device does not represent a contraindication to MRI. More recently, the advent of implants made with less ferromagnetic alloys and technical advancements of MR sequences (metal artifact reduction sequences [MARS], slice encoding for metal artifact correction [SEMAC], and multi-acquisition with variable-resonance image combination [MAVRIC]) made MRI fully feasible in patients with joint implants, with artifacts mostly limited to the area of the implant itself (Glaudemans, 2019).

Stress Fractures- "Certain stress fractures are considered high risk based on a tendency for nonunion or delayed union. High-risk stress fractures include the anterior tibial diaphysis, lateral femoral neck and femoral head…patella, medial malleolus, navicular, fifth metatarsal base, proximal second metatarsal, tibial hallux sesamoid, and talus. The second-line test to diagnose a stress fracture should be guided by the location of the patient's pain and likelihood of high-risk injury. A follow-up radiographic examination has increased sensitivity compared to initial radiographs but is less sensitive than MRI (**Bencardino**, 201**7**)."

MRI and Knee Trauma - MRI is an effective means of evaluating internal derangements of the knee with a very high accuracy for detection of meniscal injury. On MRI of the knee, meniscal injury may appear "free-floating", corresponding to a meniscal avulsion or detachment from the tibial plateau. The floating meniscus seen on MRI is a result of significant trauma. It may also be associated with significant ligamentous injury. The results of the MRI are valuable to the surgeon as **they plan** to reattach the meniscus to the tibial plateau.

MRI and Osteonecrosis – Osteonecrosis is a complication of knee surgery which may be accompanied by new or persistent pain after meniscal surgery. It can be detected by MRI with subcortical low signal intensity of T1-weighted images with or without central high signal intensity on T2-weighted images. Osteonecrosis can result in collapse of the articular surface.

MRI and Legg-Calve-Perthes Disease (LPD) –This childhood condition is associated with an insufficient blood supply to the femoral head which is then at risk for osteonecrosis. Clinical signs of LPD include a limp with groin, thigh, or knee pain. Flexion and adduction contractures may develop as the disease progresses and eventually movement may only occur in the flexion-extension plane. This condition is staged based on plain radiographic findings. MRI is used in identifying the early stage of LPD when plain films are normal. It is also used in preoperative planning to diagnose "hinge abduction" (lateral side of the femoral head contacts the

acetabular margin and femoral head does not slide as it should). However, MRI is not used as a standard diagnostic tool.

MRI and Septic Arthritis – Young children and older adults are the most likely to develop septic arthritis in the hip joint. Early symptoms include pain in the hip, groin, or thigh along with a limping gait and fever. It is sometimes hard to differentiate this condition from transient synovitis, a less serious condition with no known long-term sequelae. MRI may help in the differential diagnosis of these two conditions. Coronal T1-weighted MRI, performed immediately after contrast administration, can evaluate blood perfusion at the femoral epiphysis.

MRI and Slipped Capital Femoral Epiphysis – This condition, where the femoral head is displaced in relation to the femoral neck, is the most common hip disorder in adolescents, and it is more common in obese children. Its symptoms include a limping gait, groin pain, thigh pain and knee pain. Most cases are **stable**, and the prognosis is good with early diagnosis and treatment. Unstable slipped capital femoral epiphysis may lead to avascular necrosis. MRI is used for diagnosis of slipped capital femoral epiphysis. Its image can be oriented to a plane orthogonal to the plane of the physis to detect edema in the area of the physis.

MRI and Tarsal Coalition – This is a congenital condition in which two or more bones in the midfoot or hindfoot are joined. It usually presents during late childhood or late adolescence and is associated with repetitive ankle sprains. Mild pain, deep in the subtalar joint and limited range of motion are clinical symptoms. Tarsal coalition is detectable on oblique radiographs, but these are not routinely obtained at many institutions. Clinical diagnosis is not simple; it requires the expertise of skilled examiners. MRI is valuable in diagnosing tarsal coalition because it allows differentiation of osseous from non-osseous coalitions **and** depicts the extent of joint involvement as well as degenerative changes. It may also detect overgrowth of the medial aspect of the talus that may be associated with talocalcaneal coalitions.

MRI and Tarsal Tunnel – Tarsal Tunnel Syndrome is due to compression of the posterior tibial nerve as it passes through the tarsal tunnel into the foot. Compression can cause a sensation of burning or numbness to the bottom of the foot. Common causes include flat foot, over-protonation, and arthritis. Nerve conduction studies can reveal damage to the posterior tibial nerve. MRI may be valuable in demonstrating other structures causing extrinsic compression on the nerve (Glaser, 2016).

MRI and Chronic Recurrent Multifocal Osteomyelitis – **This n**oninfectious inflammation of the bone in children can have **non**-elevated inflammatory markers and a normal CBC. **This condition p**resents as bone pain of insidious onset with or without localized swelling but can be multifocal and have silent areas of involvement (vertebral silent lesions can lead to compression). MRI **can be approved** after initial labs and x-ray. CT is not sensitive, so the next option is a bone scan.

The American Medical Society for Sports Medicine "Choosing Wisely" Guidelines advise against ordering a knee MRI for a patient with anterior knee pain without mechanical symptoms or effusion unless the patient has not improved following completion of an appropriate functional rehabilitation program. "The most common cause of anterior knee pain is patellofemoral pain syndrome. Magnetic resonance imaging (MRI) is rarely helpful in managing this syndrome. Treatment should focus on a guided exercise program to correct lumbopelvic and lower limb strength and flexibility imbalances. If pain persists, if there is recurrent swelling or if mechanical symptoms such as locking and painful clicking are present, and radiographs are non-diagnostic, an MRI may be useful **(AMSSM, 2014)."**

The American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopaedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient… if you believe findings warrant additional advanced imaging, discuss with the consulting orthopaedic surgeon to make sure the optimal studies are ordered **(AAP, 2018)."**

POLICY HISTORY

Date	Summary
May 2021	• **Added unstable syndesmotic injury** • **Removed ankle instability** • **Added the following: navicular bone to high risk stress fracture; information about suspected bone infection in the setting of ulcers and neuropathy, following treatment for rheumatoid arthritis** • **Clarified that pre-operative imaging is for a planned surgery or procedure** • **Included early complications of hip surgery to the post operative evaluation list**
May 2020	• **Expanded orthopedic signs listing and moved to the top** • **Added note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging.** • **Added labral tear/posterior impingement to approvable list**

	• **Added flatfoot deformity** • **Expanded section about initial work-up of a mass** • **Added the National Comprehensive Care Network as a reference for imaging guidance** • **Expanded the section on stress fractures** • **Revised the section on non or delayed union** • **Added a section on loose bodies and synovial chondromatosis** • **Added a pediatric section** • **Removed Makoplasty from not approvable list** • **Added a section about joint implants and hardware to the background section** • **Added a section about chronic recurrent multifocal osteomyelitis to the background section** • **Updated references**
January 2020	• **Added 'infection of bone or joint section' previously omitted in error**
May 2019	• **Added initial statement about approvals: 'Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time'.** • **Added joint or muscle pain when x-ray completed** • **Expanded Extremity mass indications including peripheral lymphadenopathy; and mass with increased risk for malignancy** • **Added indications for foreign body and peripheral nerve entrapment** • **Modified Known Cancer indication to be more broad – 'cancer staging, cancer restaging, signs or symptoms of recurrence'** • **Expanded sections for bone fracture and infection of bone or joint to include list of signs or symptoms and laboratory findings (elevated ESR or CRP, elevated white blood cell count, positive joint aspiration)**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **HEART MRI**	**Original Date: March 26, 2008**
CPT Codes: 75557, 75559, 75561, 75563 +75565, +0698T	**Last Revised Date: March 2021**
Guideline Number: NIA_CG_028	**Implementation Date: January 2022**

GENERAL INFORMATION

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INDICATIONS FOR CARDIAC MAGNETIC RESONANCE (CMR)

Cardiomyopathy & Heart Failure

(Doherty, 2019; Patel, 2013; Yancy, 2013)

- To assess systolic and diastolic function in the evaluation of a newly diagnosed cardiomyopathy
- Suspected infiltrative disease such as amyloidosis, sarcoidosis (Birnie, 2014), hemochromatosis, or endomyocardial fibrosis if PET has not been performed
- Suspected inherited or acquired cardiomyopathy
- Diagnosis of acute myocarditis, with suspicion based upon new, unexplained findings such as:
    - Rise in troponin not clearly due to acute myocardial infarction
    - Change in ECG suggesting acute myocardial injury or pericarditis, without evident myocardial infarction
- Assessment of hypertrophic **cardiomyopathy (Ommen, 2020)**
    - **W**hen TTE is inadequate for diagnosis, management or operative planning, or when tissue characterization (degree of fibrosis) will impact indications for ICD
    - **For patients with LVH when there is a suspicion of alternative diagnoses, including infiltrative or storage disease as well as athlete's heart**

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

    - **For patients who are not otherwise as high risk for SCD, in whom the decision to proceed with an ICD is uncertain after assessment (which includes personal/family history, echocardiography), and CMR imaging is beneficial to assess for maximum LV wall thickness, ejection fraction (EF), LV apical aneurysm, and extent of myocardial fibrosis with LGE**
    - **For patients with obstructive HCM in whom the autonomic mechanism of obstruction is inconclusive on echocardiography, CMR is indicated for selection and planning of SRT (septal reduction therapy)**
    - **For patients with HCM, repeat imaging on a periodic basis (every 3-5 years) for the purpose of SCD risk stratification to evaluate changes in LGE, EF, development of apical aneurysm or LV wall thickness**
- Arrhythmogenic right ventricular cardiomyopathy to aid in identification and diagnosis (assessment of myocardial fat, fibrosis, and RV tissue characteristics), based upon reason for suspicion, such as:
    - Nonsustained ventricular tachycardia (VT)
    - Unexplained syncope
    - ECG abnormalities
    - First-degree relatives with positive genotype for ARVD
- Noncompaction cardiomyopathy to aid in the diagnosis (measurement of compacted to noncompacted myocardium) when TTE is suggestive
- Clinical symptoms and signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including but not limited to hypertrophic cardiomyopathy)
- Pulmonary hypertension in the absence of severe valvular disease

Valvular Heart Disease

- Evaluation of valvular stenosis, regurgitation, or valvular masses when transthoracic echocardiography (TTE) is inadequate (Doherty, 2017)
- Pre-TAVR assessment if the patient has not undergone cardiac CT (Otto, 2017)
- Prior to transcatheter mitral valve intervention, when TTE and TEE result in uncertain assessment of the severity of mitral regurgitation (Bonow, 2020; Wunderlich, 2018)
- Suspected clinically significant bioprosthetic valvular dysfunction and inadequate images from TTE and TEE (Doherty, 2017)

Evaluation of Intra- and Extra-Cardiac Structures

- Initial evaluation of cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli
- Re-evaluation of intracardiac mass when findings would change therapy
- Evaluation of pericardial disease to provide structural and functional assessment and differentiate constrictive vs restrictive physiology
- Assessment of left ventricular pseudoaneurysm, when TTE was inadequate
- Identification and characteristics of coronary aneurysms or anomalous coronary arteries

Pre-procedure Evaluation for Closure of ASD or PFO

- For assessment of atrial septal anatomy and atrial septal aneurysm
- For assessment of suitability for percutaneous device closure

Assessment Following LAA Occlusion

- For surveillance at 45 days or FDA guidance, if TEE or Heart CT was not done, to assess:
  - Device stability
  - **Device leaks**
  - To exclude device migration

Pre-Ablation Planning

- Evaluation of left atrium and pulmonary veins prior to radiofrequency ablation for atrial fibrillation, if cardiac CT has not been done

Aortic Pathology

- CT, MR, or echocardiogram can be used for screening and follow-up, with CT and MR preferred for imaging beyond the proximal ascending thoracic aorta
- Screening of **first-degree** relatives with a history of thoracic aortic aneurysm or dissection
- Six-month follow-up after initial diagnosis of thoracic aortic aneurysm to measure rate of change
- Annual follow-up for an enlarged thoracic aortic aneurysm (usually defined as > 4.4.cm)
- Biannual (2x/year) follow-up of enlarged aortic root or showing growth rate ≥ 0.5 cm/year
- Screening of first-degree relative with a bicuspid aortic valve
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an ascending aortic diameter >4 cm with 1 of the following:
  - Aortic diameter >4.5 cm
  - Rapid rate of change in aortic diameter
  - Family history (first-degree relative) of aortic dissection
- Patients with Turner's syndrome annually if an abnormality exists; if initial study normal, can have imaging every 5 - 10 years
- Evaluation in patients with known or suspected connective tissue disease or genetic conditions that predispose to aortic aneurysm or dissection, such as Marfan's, Ehler's Danlos or **Loeys**- Dietz syndrome (at the time of diagnosis and 6 months thereafter), followed by annual imaging (can be done more frequently if > 4.5 cm or rate of growth > 0.5 cm/year- up to twice per year)

Congenital Heart Disease (CHD)

(Sachdeva, 2020)

- For all indications below, either CT or CMR can be done

- All lesions: evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Patent Ductus Arteriosus: routine surveillance (1-2 years) in a patient with postprocedural aortic obstruction
- Eisenmenger Syndrome and Pulmonary Hypertension associated with CHD:
  - Evaluation due to change in pulmonary arterial hypertension-targeted therapy
  - Initial evaluation with suspicion of pulmonary hypertension following CHD surgery
- Aortic Stenosis or Regurgitation:
  - Routine surveillance (6-12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing size
  - Routine surveillance (2–3 years) in a child with aortic sinus and/or ascending aortic dilation with stable size (CMR only)
- Aortic Coarctation and Interrupted Aortic Arch:
  - Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation
  - Post procedure (surgical or catheter-based) routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak
- Coronary anomalies
- Tetralogy of Fallot:
  - Postoperative routine surveillance (2–3 years) in a patient with pulmonary regurgitation and preserved ventricular function (CMR only)
  - Routine surveillance (2–3 years) in an asymptomatic patient with no or mild sequelae (CMR only)
  - Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, right ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to-PA conduit
- Double Outlet Right Ventricle: Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae (CMR only)
- D-Loop Transposition of the Great Arteries (postoperative):
  - Routine surveillance (3–5 years) in an asymptomatic patient
  - Routine surveillance (1–2 years) in a patient with dilated aortic root with increasing size, or aortic regurgitation
  - Routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias
- Congenitally Corrected Transposition of the Great Arteries:
  - Unrepaired: routine surveillance (3–5 years) in an asymptomatic patient
  - Postoperative: routine surveillance (3–5 years) in an asymptomatic patient
  - Postoperative anatomic repair: routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of an RV-to-PA conduit
  - Postoperative physiological repair with VSD closure and/or LV-to-PA conduit: routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction

- Truncus Arteriosus: routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation
- Single-Ventricle Heart Disease:
  - Postoperative routine surveillance (3–5 years) in an asymptomatic patient
  - Routine surveillance (1–2 years) in an asymptomatic adult postoperative Stage 2 palliation (CMR only)
- Ebstein's Anomaly and Tricuspid Valve dysplasia (only CMR indicated):
  - Evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Pulmonary Stenosis (only CMR indicated)
  - Unrepaired: routine surveillance (3–5 years) in an asymptomatic adult with PS and pulmonary artery dilation
  - Postprocedural (surgical or catheter-based): routine surveillance (1–3 years) in an asymptomatic adult with moderate or severe sequelae
- Pulmonary Atresia (postprocedural complete repair): routine surveillance (1–3 years) in an asymptomatic adult with ≥ moderate sequelae

Coronary Artery Disease Evaluation

(CMR as an alternative to pharmacologic MPI)

- CMR, which is done pharmacologically, is used for the assessment of coronary artery disease when a stress echocardiogram (SE) cannot be performed
  - If the patient cannot walk and would otherwise be a candidate for a pharmacologic MPI, a CMR can be performed
  - If the patient can walk and is having an MPI for another reason (LBBB, CABG, etc.), MPI is chosen over CMR
- Assessment of LV wall motion to identify patients with akinetic segments that would benefit from coronary revascularization
- To identify the extent and location of myocardial necrosis in patients with chronic or acute ischemic heart disease

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BACKGROUND

(Pennell, 2010)

- CMR is an imaging modality used to assess cardiac or vascular anatomy, function, perfusion, and tissue characteristics in a single examination. In lesions affecting the right heart, CMR provides excellent visualization and volume determination regardless of RV shape. This is particularly useful in patients with congenital heart disease

- **CMR Safety** (Brignole, 2013; Indik, 2017; Nazarian, 2017; Russo, 2017)

Since many cardiac patients have cardiac implanted electrical devices, the risk of CMR to the patient and the device must be weighed against the benefit to the patient in terms of clinical value in optimal management.

Cardiac magnetic imaging (CMR) is often required when transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) provide inadequate imaging data.

Stress CMR for assessment of coronary artery disease (CAD) is performed pharmacologically either as:

- Vasodilator perfusion imaging with gadolinium contrast; **OR**
- Dobutamine inotropic wall motion (ventriculography)

With respect to CAD evaluation, since CMR is only pharmacologic (non-exercise stress), and stress echocardiography (SE) or myocardial perfusion imaging (MPI) provide similar information about CAD:

- Requests for stress CMR require **diversion** to exercise SE first, and to exercise MPI second.
- **Exemptions** for the diversion to SE or exercise MPI:
  - If body habitus or marked obesity (e.g., BMI ≥ 40) would interfere significantly with imaging with SE and MPI (Shah 2014)
  - Evaluation of young (< 55 years old) patients with documented complex CAD, who are likely to need frequent non-invasive coronary ischemia evaluation and/or frequent radiation exposure from other testing (Hirshfeld, 2018)

OVERVIEW

CMR in CORONARY ARTERY DISEASE (CAD)
(Fihn, 2012; Montalescot, 2013; Wolk, 201**4**)

Stable patients without known CAD fall into 2 categories (Fihn, 2012; Montalescot, 2013; Wolk, 201**4**):

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≥ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics

- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

Once the type of chest pain has been established from the medical record, the pretest probability of CAD (meaning obstructive CAD defined as coronary arterial narrowing ≥ 50%) is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability (Wolk, 201**4**):

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5% pretest probability of CAD, usually not requiring stress evaluation (Fihn 2012)
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CA

Abbreviations

ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CMR	Cardiac magnetic resonance (imaging)
CT	Computed tomography
ECG	Electrocardiogram
ICD	Implantable cardioverter-defibrillator
LBBB	Left bundle-branch block
LV	Left ventricular
MPI	Myocardial perfusion imaging
MR	Mitral regurgitation
MR(I)	Magnetic resonance (imaging)
RV	Right ventricle

SE	Stress echocardiography
TAVR	Transcatheter Aortic Valve Replacement
TTE	Transthoracic Echo
TEE	Transesophogeal Echo
VT	Ventricular tachycardia

POLICY HISTORY

Date	Summary
March 2021	• **Added expanded guidelines for HCM with new reference**
March 2020	• **Added general information section as Introduction which outlines requirements for documentation of pertinent office notes by a licensed clinician, and inclusion of laboratory testing and relevant imaging results for case review.** • **Added the following to the section Cardiomyopathy & Heart Failure:** o **Edited indication to assess systolic and diastolic function in the evaluation of a newly diagnosed cardiomyopathy** o **Added the following to suspected infiltrative disease such as amyloidosis, sarcoidosis, hemochromatosis, or endomyocardial fibrosis: if PET has not been performed** o **Added suspected inherited or acquired cardiomyopathy** o **Added evaluation after appropriate time interval following revascularization and/or optimal medical therapy to determine candidacy for ICD/CRT and/or to determine optimal choice of device** o **Added clinical symptoms and signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including but not limited to hypertrophic cardiomyopathy)** • **Added pulmonary hypertension in the absence of severe valvular disease** **Added the following indications to the section Evaluation of Intra- and Extra-Cardiac Structures** o **Initial evaluation of cardiac mass, suspected tumor or thrombus or potential cardiac source of emboli** o **Re-evaluation of intracardiac mass when findings would change therapy**

	o Added the following to identification and characteristics of coronary aneurysm: or anomalous coronary arteries **• Added section on Pre-Procedure Evaluation for Closure of ASD or PFO including the following indications:** **o For assessment of atrial septal anatomy and atrial septal aneurysm** **o For assessment of suitability for percutaneous device closure** **• Added section on Assessment Following LAA Occlusion including the following indications:** **o For surveillance at 45 days or FDA guidance, if TEE or Heart CT not done, to assess for:** **▪ Device stability** **▪ To exclude device migration** **▪ To assess for device leaks** **• Added the following to evaluation of left atrium and pulmonary veins prior to radiofrequency ablation for atrial fibrillation: if cardiac CT has not been done** **• Added the following to the section Aortic Pathology** **o Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an ascending aortic diameter >4 cm with 1 of the following:** **▪ Aortic diameter >4.5 cm** **▪ Rapid rate of change in aortic diameter** **▪ Family history (first-degree relative) of aortic dissection** **o Added the following to the indication of evaluation in patients with known or suspected connective tissue disease or genetic conditions that predispose to aortic aneurysm or dissection (can be done more frequently if >4.5 cm or rate of growth > 0.5 cm/year: up to twice per year)** **• Extensive update to the indications for Congenital Heart Disease to include the following:** **o For all indications noted, either CT or CMR can be done** **o All lesions: evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms** **o Specific indications based on lesion were added with interval and criteria for repeat imaging included** **o Added indication for coronary anomalies**

	• **Updated and added new references**
July 2019	• **Removed table of comparison to Cardiac CT** • **Removed global risk calculator for asymptomatic patients** • **Removed scenarios for which approval of CMR is not approvable as well as follow-up indications** • **Removed section on MRI compatibility with Pacemakers** • **Format change: moved CAD section – clarification of indication of use of MRI in CAD and removed detailed indications** • **Expanded aortic screening section with removal of chart for "normal" sizes of aortic aneurysm** • **Expanded indication for prosthetic heart valves** • **Removed indication of screening with a strong family history of cardiomyopathy** •

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Reviewed / Approved by NIA Clinical Guideline Committee

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AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **CHEST (THORAX) MRI**	**Original Date: September 1997**
CPT Codes: 71550, 71551, 71552, +0698T	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_021	**Implementation Date: January 2022**

INDICATIONS FOR CHEST MRI

The combination of superior soft tissue contrast and lack of ionizing radiation may make Chest Magnetic Resonance Imaging (MRI) preferable for the pediatric population or evaluation of the non-lung parenchyma. This must be weighed against a longer acquisition time and greater likelihood of artifact from patient motion. Chest Computed Tomography (CT) is generally better for lung evaluation. Chest Magnetic Resonance Angiography (MRA) is ordered for evaluation of the intrathoracic blood vessels. Chest MRI and Chest MRA should not be approved at the same time.

Chest Mass (non-lung parenchymal)
(Azizad, 2016; Carter, 2015, 2016, 2017; Hochhegger, 2011; Mullan, 2011)

- Mass or lesion, including lymphadenopathy, after non-diagnostic x-ray or ultrasound (Chest CT indicated for pulmonary nodule)
- Thymoma screening in Myasthenia Gravis patients (Kumar, 2015)
- **Congenital thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT) (Ferreira, 2015; Hellinger, 2011; Karaosmanoglu, 2015; Poletto, 2017)**

Chest Wall Pain (after initial evaluation with chest x-ray and/or rib series radiographs)

- History of known or suspected cancer
- Signs and symptoms of infection (non-lung parenchymal), such as:
    - Accompanying fever
    - Elevated inflammatory markers
    - Known infection at other sites
- Suspected muscle or tendon tear where imaging would change treatment

Brachial Plexopathy

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

(Mansukhani, 2013; Vijayasarathi, 2016)

- **If mechanism of injury or Electromyography/Nerve Conduction Velocity (EMG/NCV) studies are suggestive**
- **Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury**

Cystic Fibrosis
(Woods, 2020)

- **Can be an alternative to Chest CT to evaluate perfusion abnormalities, bronchiectasis, and mucus plugging if needed for treatment planning**

Vascular Diseases are better evaluated with Chest CTA or MRA
(ACR, 2019)

- **Superior vena cava (SVC) syndrome (Friedman, 2017)**
- Subclavian Steal Syndrome after positive or inconclusive ultrasound (Osiro, 2012; Potter, 2014)
- Thoracic Outlet Syndrome (ACR, 2014; Chavhan, 2017; Povlsen, 2018)
- Takayasu's arteritis (Keser, 2014)
- **Acute or chronic** aortic dissection (ACR, 2017; Barman, 2014)
- **Pulmonary hypertension - To evaluate for cause after echocardiogram or right heart catheterization (Ascha 2017, Rose-Jones 2015)**

Congenital Malformations

- Congenital heart disease with pulmonary hypertension (Pascall 2018)
- Pulmonary sequestration **(Tanzer, 2003**)

Atrial fibrillation with ablation planned
(Kolandaivelu 2012)

Preoperative/procedural evaluation

- **Pre-operative evaluation for a planned surgery or procedure**

Post-operative/procedural evaluation

- Post-surgical follow-up when records document medical reason requiring additional imaging

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BACKGROUND

Magnetic Resonance Imaging (MRI) is a noninvasive imaging technique for detection and evaluation of various disease and conditions in the chest, e.g., congenital anomalies and aneurysms. MRI may be used instead of computed tomography (CT) in patients with allergies to radiographic contrast or with impaired renal function.

OVERVIEW

MRI and Myasthenia Gravis – Myasthenia Gravis is a chronic autoimmune disease characterized by weakness of the skeletal muscles causing fatigue and exhaustion that is aggravated by activity and relieved by rest. It most often affects the ocular and other cranial muscles and is thought to be caused by the presence of circulating antibodies. Symptoms include ptosis, diplopia, chewing difficulties, and dysphagia. Thymoma has a known association with myasthenia. Contrast-enhanced MRI may be used to identify the presence of a mediastinal mass suggestive of myasthenia gravis in patients with renal failure or allergy to contrast material.

MRI and Thoracic Outlet Syndrome – Thoracic outlet syndrome is a group of disorders involving compression at the superior thoracic outlet that affects the brachial plexus, the subclavian artery, and veins. It refers to neurovascular complaints due to compression of the brachial plexus or the subclavian vessels. Magnetic resonance multi-plane imaging shows bilateral images of the thorax and brachial plexus and can demonstrate the compression of the brachial plexus and venous obstruction.

MRI and Brachial Plexus - MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

POLICY HISTORY

Date	Summary
April 2021	• **Added details on brachial plexopathy imaging** • **Expanded introduction section** • **Added Cystic Fibrosis imaging (alternative to CT)** • **Clarified pre-operative evaluation for a planned surgery or procedure**
May 2020	• **Added Chest Wall Pain section:** o ***Chest Wall Pain (after initial evaluation with chest x-ray and/or rib series radiographs)*** • ***History of known or suspected cancer*** • ***Signs and symptoms of infection (non-lung parenchymal), such as:*** o ***Accompanying fever*** o ***Elevated inflammatory markers*** o ***Known infection at other sites*** • ***Suspected muscle or tendon tear where imaging would change treatment***

	• **Thoracic Aortic Disease: removed section and added note: *Chest CTA or MRA is preferred for vascular pathology*** • **Thoracic Outlet Syndrome: removed section and added note: *Chest CTA or MRA is preferred for vascular pathology*** • **Brachial Plexopathy: added note: *Chest MRI is preferred study vs. neck or shoulder MRI***
May 2019	• **Expanded indications including: vascular and congenital anomalies** • **Updated thoracic aortic section and reformatted to match other guidelines.**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guideline **CERVICAL SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72141, 72142, 72156, +0698T	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_040	**Implementation Date: January 2022**

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

For evaluation of neurologic deficits
(Acharya, 2019; ACR, 2013; NASS, 2010; 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 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**)

- 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**

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** neurological deficits **or symptoms** (Rao, 2018)- **see neurological deficit section above**
- **When combo requests are submitted (e.g., 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) (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)

- 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 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)
- **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 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**; Koivikko, 2008; **Taljanovic, 2009)**
- 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:
    - 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") (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**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**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 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
- **Initial staging or re**-staging of **a** known **primary spinal** tumor
- **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 (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 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 (ACR, 2018; Ziu, 2019)

For evaluation of inconclusive finding on prior imaging that requires further clarification
- **One follow-up exam to ensure no suspicious change has occurred in prior imaging finding. No further surveillance unless specified as highly suspicious or change was found on last follow-up exam** (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
(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 Indications for a Cervical Spine MRI

(Note- See combination requests**, below, for initial advanced imaging assessment and pre-operatively)**

- Tethered cord or spinal dysraphism (known or suspected), based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata (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** (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)(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))
  - 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))**

COMBINATION OF STUDIES WITH CERVICAL SPINE MR

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

Brain MRI/Cervical MRI

- **For evaluation of known Arnold-Chiari Malformation**

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

- 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 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**
- **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 (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 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))**

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)

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 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** • **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.		

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 (V**arshney**, 2017).
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only age 1 and is recommended in patients <1 year **old** only if symptomatic (Comi, 2011).

POLICY HISTORY

Date	Summary
April 2021	• **Added/modified** o **Modified section on neurological deficits** o **Back pain in a child added/modified red flags** o **Gait table in background** o **Post-surgical modified/clarified surgical criteria for combination exams and surgeon preference for exam type** o **Removed myelopathy combination studies** o **Updated/added MS Criteria** ▪ **Combination section for initial imaging and follow up** ▪ **Added pediatric MS** o **Modified known tumor imaging into primary and metastatic disease** o **Added toe walking for pediatric patients** o **Modified Combination exam wording** o **Added Achondroplasia to criteria**
May 2020	• **Added:** o **For evaluation of neurologic deficits are new**

	o **Added Imaging of Ossification of the Posterior Longitudinal Ligament (OPPL)** o **Added imaging in high risk patients predisposed to spinal injury** o **Added imaging in high risk patients for atlantoaxial injury** o **Added transverse myelitis** o **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** o **Added to background of imaging of infection** o **Added Osteopathic Manipulative medicine to conservative care therapy**
June 2019	• **Added:** o **new or worsening objective neuro deficits for chronic and acute back pain** o **CSF leak** o **last 6 months for allowable post op f/u period and removed EMG comment** o **red flags specifically for peds back pain and pain related to malignancy, infection, inflammation** o **new sections: pars defect; compression fractures; congenital abnormalities including section on scoliosis and vertebral anomalies in children w/back pain;** o **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**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **UPPER EXTREMITY MRI** **(Hand, Wrist, Arm, Elbow, Long bone, or Shoulder MRI)**	**Original Date: September 1997**
CPT Codes: 73218, 73219, 73220, 73221, 73222, 73223, +0698T	**Last Revised Date: May 2021**
Guideline Number: NIA_CG_057-3	**Implementation Date: January 2022**

INDICATIONS FOR UPPER EXTREMITY MRI (HAND, WRIST, ARM, ELBOW or SHOULDER) (Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI.

Joint specific provocative orthopedic examination (see Table 1)
Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging.

- Shoulder (Bencardino, 2013; Jain, 2017; Loh, 2016, Somerville, 2017)
    - Any positive test listed
        - Rotator cuff weakness (van Kampen, 2014)
        - **Bear hug test**
        - **Belly press test**
        - Drop **arm test**
        - Full can test
        - Hornblower's sign
        - **Internal rotation lag sign**
        - **Supraspinatus test (e.g., Jobe's or Empty can) in the setting of suspected rotator cuff tear**
- Elbow (Kane, 2014; Karbach, 2017)

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

    - Any positive test listed
        - Valgus stress
        - **Varus stress**
        - Posterolateral rotatory drawer test
        - **Milking maneuver**
        - **Push-up test**
- Wrist (**Pandey**, 2014; Ruston, 2013)
    - Any positive test listed
        - Watson test (scaphoid shift test)
        - Scapholunate ballottement test
        - Reagan test (lunotriquetral ballottement test)

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed

(Park, 2010; Pieters, 2020)

- Persistent joint or **musculotendinous** pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or **physician**-supervised exercise**) of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment.

Other Specific Shoulder Conditions which are approvable after active conservative therapy (above) and x-ray:

- **Shoulder Impingement—Hawkin's, Neer's, Painful arc, Load and shift, and Yocum tests**
- **Non-Traumatic Shoulder Instability—Sulcus, Surprise, Anterior or Posterior draw, Apprehension, Anterior slide, Clunk, Crank, Empty can, HERI (hyperextension-internal rotation) tests**
- **Glenoid labral tear (i.e., SLAP lesion)—Apprehension, Relocation, Surprise, O'Brien's, Superior labral, Anterior slide, Jerk, Compression rotation, Crank tests**

Shoulder Dislocations

(Galvin, 2017; Kilocyne, 2017)

- **Recurrent**
- **First time in any of the situations below that increase the risk or repeated dislocation**
    - **Glenoid or humeral bone loss on x-ray**
    - **14-35 year-old competitive contact sport athlete**

Extremity Mass

- Mass or lesion after non-diagnostic x-ray or ultrasound (**Murphey, 2018**)
    - If superficial, then ultrasound is the initial study
    - If deep, then x-ray is the initial study

Known Cancer of the Extremity
(**Bestic, 2019**; Fitzgerald, 2015; Holzapfel, 2015; Kircher, 2012; **NCCN, 2019**)

- Cancer staging
- Cancer **r**estaging
- Signs or symptoms of recurrence

Infection of Bone or Joint
(Beaman, 2017; Dodwell, 2013; Glaudemans, 2019)

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fever
    - Laboratory findings of infection include:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- **Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone or deep infection is suspected**
    - **Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell (Bowers, 2020)**

Osteonecrosis (e.g., Avascular necrosis (AVN))
(Felten, 2019; Murphey, 2014; 2016)

- Abnormal x-ray
- Normal **x**-rays but symptomatic and **high**-risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse (Fukushima, 2010), sickle cell anemia (Wali, 2011))

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis) (Colebatch, 2013; Narvaez, 2010)

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- I**nitial i**maging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- **Follow-up to determine treatment efficacy in the following:**
    - **Early rheumatoid arthritis**
    - **Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory**

Bone Fracture or Ligament Injury

- Suspected stress or insufficiency fracture with a negative initial x-ray (**Bencardino, 2017**; Sadineni, 2015; Yin, 2010)
    - Repeat x-rays in 10-14 days if negative or non-diagnostic
- Pathologic fracture on x-ray (Fayad, 2005)
- Intraarticular fractures that may require surgery
- Suspected scaphoid fracture with negative x-rays
- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion (Morshed, 2014).
- Clinical suspicion based on mechanism of injury and physical findings and x-ray completed
    - TFCC (triangular fibrocartilage complex) injury (Barlow, 2016; Ng, 2017)

Occult wrist ganglion, after indeterminate ultrasound

(Meena, 2014)

- Clinical suspicion and failed 4 weeks conservative treatment including all of the below:
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray **completed** (Smith, 2012; **Taljanovic, 2019**; Van Dijk, 2010; Van Bergen, 2016)

- Clinical suspicion based on mechanism of injury and physical findings
- Loose bodies or synovial chondromatosis seen on x-ray or ultrasound
    - In the setting of joint pain (Rajani, 2016)

Foreign Body

(Laya, 2017)

- Indeterminate x-ray and ultrasound

Tendon or Muscle Rupture after x-ray

(Garras, 2012; Peck, 2017; Wilkins, 2012)

- Clinical suspicion based on mechanism of injury and physical findings **(i.e., Popeye, Hook, Yergasons sign)**

Peripheral Nerve Entrapment (e.g., carpal tunnel)

(Domkundwar, 2017; Dong, 2012, Donovan, 2010; Meyer, 2018; Tos, 2015)

- Abnormal **e**lectromyogram or **n**erve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):

- Activity modification
- Rest, ice, or heat
- Splinting or orthotics
- Medication

Brachial Plexopathy

(**Mansukhani, 2013**; Vijayasarathi, 2016)

- **If mechanism of injury or EMG/NCV studies are suggestive**
- **Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury**

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications
- Joint prosthesis loosening or dysfunction, x-rays non-diagnostic (Fritz, 2014; 2015)

Table 1: Positive Orthopedic Joint Tests, Upper Extremity

ELBOW

Moving valgus stress test
Hook test
Passive forearm pronation
Biceps squeeze test
Biceps Aponeurosis (BA) flex test
Table top relocation test

SHOULDER

Drop Arm Test
External rotation lag sign 0 and 90 degrees
Full can test
Hook test
Hornsblower test
Internal rotation lag sign
Lift off test
Popeye sign

WRIST

Snuff box pain (after initial x-ray)
Derby relocation test

Ulnar foveal sign/test
Press test
Ulnocarpal stress test (if concern for TFCC tear)

BACKGROUND
Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI **can** positively influence clinicians' diagnoses and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW
***Conservative Therapy:** (musculoskeletal) 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, (**including** crutches, immobilizer, metal braces, orthotics, rigid **stabilizer,** or splints, etc. and not to include neoprene sleeves), medications, injections (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 chiropractic care.

****Home Exercise Program - (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-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).

Rotator Cuff Tears – 3.0 Tesla MRI has been found valuable for the detection of partial thickness rotator cuff tendon tears and small rotator cuff tendon tears. It is especially useful in detecting the partial tears due to increased spatial resolution. Increased spatial resolution results in precise measurements of rotator cuff tendon tears in all 3 planes, and it also reduces acquisition time which reduces motion artifacts. 3.0 Tesla makes it possible to adequately evaluate tendon edges and avoid underestimation of tears. MRI is less invasive than MR arthrography, and it is faster and less expensive. MRI may be useful in the selection of patients that may benefit from arthroscopy.

MRI and Occult Fractures – Magnetic resonance imaging may help to detect occult fractures of the elbow when posttraumatic elbow effusions are shown on radiographs without any findings of fracture. Effusions may be visualized on radiographs as fat pads, which can be elevated by the presence of fluid in the joint caused by an acute fracture. MRI may be useful when

effusions are shown on radiographs without a visualized fracture, but there is a clinical suspicion of a lateral condylar or radial head fracture.

MRI and Avascular Necrosis – Sports, such as racquetball and gymnastics, may cause repeated microtrauma due to the compressive forces between the radial head and capitellum. Focal avascular necrosis and osteochondritis dissecans of the capitellum may result. MRI can be used to evaluate the extent of subchondral necrosis and chondral abnormalities. The images may also help detect intraarticular loose bodies.

MRI and Acute Osseous Trauma – Many elbow injuries result from repetitive microtrauma rather than acute trauma, and the injuries are sometimes hard to diagnose. Non-displaced fractures are not always evident on plain radiographs. When fracture is suspected, MRI may improve diagnostic specificity and accuracy. T1-weighted images can delineate morphologic features of the fracture.

MRI and Brachial Plexus - MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

Adhesive Capsulitis a.k.a. Frozen Shoulder (Ramirez, 2019; Redler, 2019; Small, 2018) - MRI is the preferred modality for imaging after a failure of improvement with active conservative therapy. Affected patients have impaired range of shoulder motion with forward flexion, abduction, and external and internal rotation which may be associated with pain. Clinically, it can be distinguished from rotator cuff pathology, where passive range of motion is preserved, or neoplasm which may also have associated fever or weight loss. Treatment is with a combination of intracapsular steroid injection and active conservative care. Anti-inflammatory medications are also given to facilitate active treatment. When nonsurgical management, including anti-inflammatory medication, active care (physical therapy, a supervised home exercise program or manipulations), and injections, have failed to provide relief of symptoms by 9 to 12 months, surgical intervention is indicated, but this represents the minority of patients.

The American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric **orthopedics,** as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate

interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient. If you believe findings warrant additional advanced imaging, discuss with the consulting **orthopedic** surgeon to make sure the optimal studies are ordered **(AAP, 2018)."**

POLICY HISTORY

Date	Summary
May 2021	• **Additional signs for rotator cuff tear that are considered useful** • **Removed signs for impingement, shoulder instability and glenoid labral tear since active conservative therapy should be done first** • **Added section about impingement, nontraumatic shoulder instability and glenoid labral tear requiring active conservative therapy** • **Added information for the following: shoulder dislocation; suspected bone infection in the setting of ulcers and neuropathy; brachial plexopathy; treatment for rheumatoid arthritis**
May 2020	• **Expanded the list of orthopedic signs and Added note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging.** • **Added information about adhesive capsulitis** • **Clarified that if an MR Arthrogram fits approvable criteria, approve as MRI.** • **Revised the information about an evaluation of an extremity mass.**
May 2019	• **Added initial statement about approvals: 'Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time'.** • **Expanded Extremity mass indications including peripheral lymphadenopathy; and mass with increased risk for malignancy** • **Added indications for foreign body and peripheral nerve entrapment** • **Modified Known Cancer indication to be more broad – 'cancer staging, cancer restaging, signs or symptoms of recurrence'** • **Expanded sections for bone fracture and infection of bone or joint to include list of signs or symptoms and laboratory findings (elevated ESR or CRP, elevated white blood cell count, positive joint aspiration)**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines: **UNLISTED STUDY**	**Original Date: September 2013**
76497 - Unlisted CT **76498 – Unlisted MRI, +0698T**	**Last Revised Date: August 2021**
Guideline Number: NIA_CG_063	**Implementation Date: January 2022**

IMPORTANT NOTE
The CPT code that has been selected is considered to be an "unlisted code".

UNLISTED MRI
CPT Code 76498, Unlisted MRI, can be used in the context of:

- **R**adiation treatment planning
- **Whole Body MRI requests related to Rare Genetic Disease Screening as determined by professional society recommendations (not an all-inclusive list):**
  - **Li-Fraumeni Syndrome (LFS)**
  - **Constitutional Mismatch Repair Deficiency (CMMRD) syndrome**
  - **Hereditary retinoblastoma**
  - **Neurofibromatosis Type 1**
  - **Hereditary Paraganglioma-Pheochromocytoma (PGL/PCC) Syndrome**
  - **Rhabdoid Tumor Predisposition Syndrome (RTPS)**
  - **Increased genetic risk related to other cancer-predisposing syndromes**

For all other MRI studies, another CPT code should be selected that describes the specific service being requested; otherwise, this procedure cannot be approved.

***NOTE: If there is concern for bone marrow pathologies (for example, diffuse or multifocal marrow disorders; marrow involvement in storage diseases or progression of smoldering multiple myeloma (SMM) to multiple myeloma (MM) or high risk SMM patients) a Bone Marrow MRI study may be more appropriate, please see NIA GL 059*.**

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

UNLISTED CT

CPT Code 76497, Unlisted CT, can be used in the context of:

- **Low Dose Whole Body CT**
  - **Initial workup of plasma cell dyscrasia (to differentiate MGUS, smoldering, and active myeloma/plasmacytoma)**
  - **Initial staging of known or suspected of active or smoldering multiple myeloma/plasmacytoma**
  - **Restaging of known active or smoldering myeloma/plasmacytoma- annually if no change in patient status, or at shorter interval clinically indicated by signs/symptoms, laboratory, or radiographic concern for disease relapse or progression**

For all other CT studies, another CPT code should be selected that describes the specific service being requested, otherwise this procedure cannot be approved.

BACKGROUND

Multiple myeloma is a clonal plasma cell proliferative disorder hallmark by primary infiltration of bone marrow and the production of abnormal immunoglobulins. Myeloma is the second most common hematologic malignancy after lymphoma. Osseous disease is the most prominent finding in patients with suspected multiple myeloma (including smoldering myeloma).

Given the increased sensitivity of cross-sectional imaging and low dose that the studies can be performed at this method is now preferred over skeletal radiographs. Whole body low dose CT (WBLD CT) or PET/CT the initial study of choice to evaluate patients with known or suspected multiple myeloma and smoldering myeloma (NCCN 2021). Whole body imaging with MRI is the initial study of choice for initial evaluation of solitary plasmacytoma (NCCN 2021), which is ordered as Bone Marrow MRI. Whole body imaging with PET/CT is the first choice for initial imaging of solitary plasmacytoma (NCCN 2021).

POLICY HISTORY

Date	Summary
August 2021	• **Added section for whole body MRI for rare genetic disease screening** • **Added: *NOTE: If there is concern for bone marrow pathologies (for example, diffuse or multifocal marrow disorders; marrow involvement in storage diseases or progression of smoldering multiple myeloma (SMM) to multiple myeloma (MM) or high risk**

	SMM patients) a Bone Marrow MRI study may be more appropriate, please see NIA GL 059*. • **Added: UNLISTED CT** **CPT Code 76497, Unlisted CT, can be used in the context of:** • **Low Dose Whole Body CT** o **Initial workup of plasma cell dyscrasia (to differentiate MGUS, smoldering, and active myeloma/plasmacytoma)** o **Initial staging of known or suspected of active or smoldering multiple myeloma/plasmacytoma** o **Restaging of known active or smoldering myeloma/plasmacytoma- annually if no change in patient status, or at shorter interval clinically indicated by signs/symptoms, laboratory, or radiographic concern for disease relapse or progression** **For all other CT studies, another CPT code should be selected that describes the specific service being requested, otherwise this procedure cannot be approved.** • **Added background information**
May 2020	• **No changes**
August 2019	• **No changes**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **THORACIC SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72146, 72147, 72157, +0698T	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_042	**Implementation Date: January 2022**

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

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

- **With any of the following new neurological deficits documented on physical exam**
  - **Extremity muscular weakness**
  - **Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign) or abnormal reflexes (Teoli, 2021)**
  - **Absent/decreased sensory changes along a particular thoracic 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 1 for more details**)
- **Suspected cord compression with any neurological deficits as listed above.**

For evaluation of back pain with any of the following
(Allegri, 2016; A**A**NSCNS, 2014; Jarvik, 2015)

- With new or worsening objective **neurologic deficits (as listed above)** on exam
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a thoracic radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain (NASS, 2013))
- **Isolated back pain in pediatric population (ACR, 2016) – conservative care not required if red flags present (see combination request below cervical 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: 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**

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**
- **Prior to spinal cord stimulator to exclude canal stenosis if no prior MRI imaging of the thoracic spine has been done recently (Carayannopoulos, 2019)**
- **CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))**
- **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 thoracic spine CT and MRI thoracic spine are both approvable (not an all-inclusive list):**
        - **OPLL (Ossification of posterior longitudinal ligament)-**
            - **Most common in cervical spine (rare but more severe in thoracic spine) (Choi, 2011)**
        - **Pathologic or complex fractures**
        - **Malignant process of spine with both bony and soft tissue involvement**
        - **Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient**

For evaluation of suspected myelopathy
(ACR, 2015; Behrbalk, 2013; Davies, 2018; Sarbu, 2019; Vilaca, 2016)

- **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 known or suspected multiple sclerosis (MS)
(**ACR, 2015; CMSC, 2018; Filippi, 2016; Kaunzner, 2017**)

- **Suspected or known MS with new or changing symptoms suggesting underlying thoracic spinal cord disease (i.e., transverse myelitis, progressive myelopathy)**
- **Suspected or known pediatric demyelinating diseases (MS/ADEM)**
- **Combination studies for MS**
    - **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 as 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; Koivikko, 2008; Taljanovic, 2009)**
- **When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation**

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

For evaluation of known or new compression fractures (ACR, 2018)

- With history of malignancy
    - **To aid in differentiation of benign osteoporotic fractures from metastatic disease**

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

For evaluation of tumor, cancer, or metastasis with any of the following (MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)
(**Kim, 2012; McDonald, 2019; Roberts, 2010)**

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 back pain or radiculopathy or back pain occurs at night and wakes the patient from sleep with known active cancer and a tumor that tends to metastasize to the spine (McDonald,2019; Ziu, 2019)**

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

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases
- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection, abscess, or inflammatory disease
(ACR, 2015; Lerner, 2018)
- **Infection**

    - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings (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)
- **Spondyloarthropathies**
    - **Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup**

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma
(ACR, 2015)
- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Thoracic Spine MRI
(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)
- **Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata (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 (Hitson, 2015)**
    - **Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation**
- **Syrinx or syringomyelia (known or suspected)**
    - **With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis (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))**

COMBINATION STUDIES WITH THORACIC SPINE MRI

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 MRIs
- **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 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))**
- **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)**
    - **Suspected 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))

BACKGROUND

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

OVERVIEW

Ankylosing Spondylitis/Spondyloarthropathies is a cause of back or sacroiliac pain of insidious onset (usually > 3 month), associated with morning stiffness not relieved with rest (usually age at onset < 40). It is associated with any of the following (Akgul, 2011; Bennett, 2010; Ostergaard, 2012; Si**e**per, 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) 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.

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

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: MRI 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.		

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

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

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

- Dermal sinus tract (a rare congenital deformity)
- Diastematomyelia (split spinal cord)
- Lipoma
- Tumor
- Thickened/tight filum terminale

- History of spine trauma/surgery
- Arnold-Chiari Malformation

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

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

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

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

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).

Cauda Equina Syndrome - Symptoms include severe back pain or sciatica along with one or more of the following:
- Saddle anesthesia - loss of sensation restricted to the area of the buttocks, perineum, and inner surfaces of the thighs (areas that would sit on a saddle)
- Recent bladder/bowel dysfunction (as listed above)
- Achilles reflex absent on both sides
- Sexual dysfunction that can come on suddenly
- Absent anal reflex and bulbocavernosus reflex

Spinal MRI and Neuromyelitis optica spectrum disorders (NMOSD) - NMOSD are inflammatory disorders of the central nervous system characterized by severe, immune-mediated demyelination and axonal damage predominantly affecting the optic nerves and spinal cord, but **NMOSD may** also **affect** the brain and brainstem. NMOSD can be distinguished from multiple sclerosis and other inflammatory disorders by the presence of the aquaporin-4 (AQP4) antibody. Features of NMOSD include attacks of bilateral or sequential optic neuritis acute transverse myelitis and the area postrema syndrome (with intractable hiccups or nausea and vomiting). The evaluation of suspected NMOSD entails brain and spinal cord neuroimaging. In contrast to MS (in which spinal cord involvement tends to be incomplete and asymmetric), NMOSD have a longer extent of spinal cord demyelination generally involving three or more vertebral segments.

POLICY HISTORY

Date	Summary
April 2021	• **Added/modified** o **Modified section on neurological deficits** o **Back pain in a child added/modified red flags** o **Gait table in background** o **Post-surgical modified/clarified surgical criteria for combination exams** o **Removed myelopathy combination studies** o **Updated/added MS Criteria** ▪ **Combination section for initial imaging and follow up** ▪ **Added pediatric MS** o **Modified known tumor imaging into primary and metastatic disease** o **Added toe walking for pediatric patients** o **Modified Combination exam wording**
May 2020	• **Added** o **For evaluation of neurologic deficits when new deficits are present** o **Removed pars defect section** o **Added ankylosing spondylitis for evaluation of trauma/acute injury** o **Added follow up of osteoporotic fracture from metastatic disease** o **Added transverse myelitis** o **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 o **Added Imaging of Ossification of the Posterior Longitudinal Ligament (OPPL)** o **Added Osteopathic Manipulative medicine to conservative care therapy**
June 2019	• **Added:** o **new or worsening objective neuro deficits for chronic and acute back pain** o **CSF leak** o **last 6 months for allowable post op f/u period and removed EMG comment** o **red flags specifically for peds back pain and pain related to malignancy, infection, inflammation** o **new sections: pars defect; compression fractures; congenital abnormalities including section on scoliosis and vertebral anomalies in children w/back pain;** o **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** o **Myelopathy** o **Pre op for spinal cord stimulator** o **Evaluation of MS including NMO disorders and recurrent transverse myelitis** o **Back pain in cancer patients with known active cancer in tumors that tend to metastasize** o **Expanded on tethered cord in Other Indications for Imaging and added content on sacral dimple**

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R**eviewed / 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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc. *	
Clinical guidelines **ORBIT, FACE, NECK, SINUS MRI**	**Original Date: November 2007**
CPT Codes: 70540, 70542, 70543, +0698T	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_014	**Implementation Date: January 2022**

INDICATIONS FOR ORBIT MRI

MRI is superior for the evaluation of the visual pathways, globe and soft tissues; CT is preferred for visualizing bony detail and calcifications (Hande, 2012; Kennedy, 2018)

- **Abnormal external or direct eye exam**
  - Exophthalmos (proptosis) or enophthalmos
  - Ophthalmoplegia with concern for orbital pathology
  - Unilateral optic disk swelling (Hata, 2017; Margolin, 2019; Passi, 2013)
  - Documented visual field defect (Fadzil, 2013; Kedar, 2011; Prasad, 2012; Sadun, 2011)
    - Unilateral or with **abnormal optic disc(s) (e.g., optic disc blurring, edema, or pallor)**; **AND**
    - Not explained by underlying diagnosis, glaucoma, or macular degeneration

- **Optic neuritis**
  (**CMSC, 2018;** Gala, 2015; Srikajon, 2018; Voss, 2011)
  - If atypical presentation, severe visual impairment, or poor recovery following initial onset or treatment onset OR
  - **If needed to confirm optic neuritis and rule out compressive lesions**

- **Orbital trauma**

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

(Lin, 2012; Sung, 2014)
    - Physical findings of direct eye injury
    - Suspected orbital trauma with indeterminate x-ray or ultrasound

- **Orbital or ocular mass/tumor, suspected or known**
(Hande, 2012; Kedar, 2011)

- **Clinical suspicion of orbital infection**
(Hande, 2012; Kennedy, 2018)

- **Clinical suspicion of osteomyelitis**
(Arunkumar, 2011; Lee, 2016)
    - Direct visualization of bony deformity **OR**
    - Abnormal x-rays

- **Clinical suspicion of Orbital Inflammatory Disease** (e.g., eye pain and restricted eye movement with suspected orbital pseudotumor)
(Pakdaman, 2014)

- **Congenital orbital anomalies**

- **Complex strabismus to aid in diagnosis, treatment and/or surgical planning (Demer, 2002; Kadom, 2008)**

NOTE: FOR OTHER ORBIT MRI INDICATIONS, CLICK HERE

INDICATIONS FOR ORBIT AND BRAIN MRI COMBINATION STUDIES:

- **Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders (Behbehani, 2007)**
- **Bilateral optic disk swelling (papilledema) with vision loss (Margolin, 2019)**
- **Optic neuritis if atypical presentation, severe visual impairment, or poor recovery following initial onset or treatment onset (CMSC, 2018)**
- **Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis (Wingerchuk, 2015)**
- **For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology (Lawson, 2000)**

INDICATIONS FOR FACE/SINUS MRI:

- **Rhinosinusitis** (Kirsch, 2017)
    - Clinical **s**uspicion of fungal infection (Gavito-Higuera, 2016)
    - Clinical **s**uspicion of orbital or intracranial complications (**Arunkumar, 2011; Lee, 2016)**, such as
        - Preseptal, orbital, or central nervous system infection
        - Osteomyelitis
        - Cavernous sinus thrombosis

- **Sinonasal obstruction, suspected mass, based on exam, nasal endoscopy, or prior imaging** (Kirsch, 2017; Rosenfeld, 2015)

- **Suspected infection**
    - Osteomyelitis (after x-rays) (Pincus, 2009)
    - Abscess

- **Anosmia or Dysosmia based** on objective testing that is persistent and of unknown origin (Policeni, 2017; Rouby, 2011; Zaghouani, 2013)

- **Granulomatosis** with polyangiitis (Wegener's granulomatosis) disease (Pakalniskis, 2015)

- **Face mass**
  (Kirsch, 2017; Koeller, 2016; **Kuno, 2014**)**:**
    - Present on physical exam and remains non-diagnostic after x-ray or ultrasound is completed
    - Known or highly suspected head and neck cancer on examination (Kirsch, 2017)
    - Failed 2 weeks of treatment for suspected infectious adenopathy (Haynes, 2015)

- **Facial trauma**
  (Echo, 2010; Lin, 2012; Raju, 2017; Sung, 2014)
    - Physical findings of direct facial bone injury
    - **For further evaluation of a known fracture for treatment or surgical planning**

  Note: CSF (cerebrospinal fluid) rhinorrhea - Sinus CT is indicated when looking to characterize a bony defect. CSF otorrhea - Temporal Bone CT is indicated. For intermittent leaks and complex cases, consider CT/MRI/Nuclear Cisternography). CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)

- **Trigeminal neuralgia/neuropathy** (for evaluation of the extracranial nerve course)

- If atypical features (e.g., bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution, progression) (ACR, 2017; Hughes, 2016; Policeni, 2017)

NOTE: FOR OTHER FACE/SINUS MRI INDICATIONS, CLICK HERE

INDICATIONS FOR FACE/SINUS AND BRAIN MRI COMBINATION STUDIES:

- **Anosmia or dysosmia on objective testing that is persistent and of unknown origin (ACR, 2017; Decker, 2013; Policeni, 2017; Zaghouani, 2013)**
- **Granulomatosis with polyangiitis (Wegener's granulomatosis) disease (Pakalniskis, 2015)**
- **Trigeminal neuralgia that meets the above criteria (Hughes 2016; Policeni, 2017)**
- **For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology (Lawson, 2000).**

INDICATIONS FOR NECK MRI:

Suspected tumor or cancer:
(ACR, 2018a)

- Suspicious lesions in mouth or throat (Kuno, 2014).
- Suspicious mass/tumor found on another imaging study and needing clarification
- Neck mass **or lymphadenopathy** (non-parotid or thyroid)
  - **Present on physical exam and remains non-diagnostic after ultrasound is completed (Kuno, 2014)**

    Note: For discrete cystic lesions of the neck, an ultrasound should be performed as initial imaging unless there is a high suspicion of malignancy

  - Increased risk for malignancy with one or more of the following findings (Pynnonen, 2017):
    - Fixation to adjacent tissues
    - Firm consistency
    - Size >1.5 cm
    - Ulceration of overlying skin
    - Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered of infectious cause
    - History of cancer
  - Failed 2 weeks of treatment for suspected infectious adenopathy (Haynes, 2015).
- Neck Mass (parotid) (ACR, 2018a)
  - Parotid mass found on other imaging study and needing further evaluation (US is the initial imaging study of a parotid region mass)

- Neck Mass (thyroid) (ACR, 2018b)
    - Staging and monitoring for recurrence of known thyroid cancer (ACR, 2018b).
    - To assess extent of thyroid tissue when other imaging suggests extension through the thoracic inlet into the mediastinum or concern for airway compression (Gharib 2016; Lin, 2016)

    Note: US is the initial imaging study of a thyroid region mass. CT is preferred over MRI in the evaluation of thyroid masses since there is less respiratory motion artifact. Chest CT may be included for preoperative assessment in some cases

Pediatric patients (≤ 18 years old):
(Wai, 2020)

- Neck masses if ultrasound is inconclusive or suspicious (Brown, 2016)
- History of malignancy

Known or suspected deep space infections or abscesses of the pharynx or neck
(Meyer, 2009)

Other indications for a Neck MRI:

- MR Sialography to evaluate salivary ducts (Burke, 2011; Ren, 2015)
- Vocal cord lesions or vocal cord paralysis (Dankbaar, 2014).
- **Unexplained ear pain when ordered by a specialist with all of the following (Earwood, 2018)**
    - **Otoscopic exam, nasolaryngoscopy, lab evaluation (ESR, CBC) AND**
    - **Risk factor for malignancy i.e., tobacco use, alcohol use, dysphagia, weight loss OR age older than 50 years**
- Diagnosed primary hyperparathyroidism when surgery is planned
    - Previous nondiagnostic ultrasound or nuclear medicine scan (Khan, 2014; Piciucchi, 2012).
- Bell's palsy/hemifacial spasm (for evaluation of the extracranial nerve course)
    - If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset (Quesnel, 2010)
- Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course) (ACR, 2017; Mumtaz, 2014; Policeni, 2017)
- **Brachial plexopathy if mechanism of injury or EMG/NCV studies are suggestive (Vijayasarathi, 2016)**

    Note: Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury

NOTE: FOR OTHER NECK MRI INDICATIONS, CLICK HERE

INDICATIONS FOR NECK AND BRAIN MRI COMBINATION STUDIES:

- **Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course) (ACR, 2017; Mumtaz, 2014; Policeni, 2017)**
- **For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology (Lawson, 2000).**

OTHER INDICATIONS FOR ORBIT/FACE/SINUS/NECK MRI

Known tumor or cancer of skull base, orbits, sinuses, face, tongue, larynx, nasopharynx, pharynx, or salivary glands

- Initial staging (Kuno, 201**4**)
- Restaging during treatment
- Suspected recurrence or new metastases based on symptoms or examination findings
    - New mass
    - Change in lymph nodes (Hoang, 2013)
- Surveillance appropriate for tumor type and stage

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

Pre-operative/procedural evaluation

- **Pre-operative evaluation for a planned surgery or procedure**

Post- operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications

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BACKGROUND:

Magnetic resonance imaging (MRI) is used in the evaluation of face and neck region masses, trauma, and infection. The soft-tissue contrast between normal and abnormal tissues provided by MRI is sensitive for differentiating between inflammatory disease and malignant tumors and permits the precise delineation of tumor margins. MRI is used for therapy planning and follow-up of face and neck neoplasms. It is also used for the evaluation of neck lymphadenopathy and vocal cord lesions.

CT scanning remains the study of choice for the imaging evaluation of acute and chronic inflammatory diseases of the sinonasal cavities. MRI is not considered the first-line study for routine sinus imaging because of limitations in the definition of the bony anatomy and length of imaging time. MRI for confirmation of diagnosis of sinusitis is discouraged because of hypersensitivity (overdiagnosis) in comparison to CT without contrast. MRI, however, is superior to CT in differentiating inflammatory conditions from neoplastic processes. MRI may better depict intraorbital and intracranial complications in cases of aggressive sinus infection, as well as differentiating soft-tissue masses from inflammatory mucosal disease. MRI may also identify fungal invasive sinusitis or encephaloceles.

Anosmia - Nonstructural causes of anosmia include post viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause. **Anosmia and dysgeusia have been reported as common early symptoms in patients with COVID-19, occurring in greater than 80 percent of patients. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made given the high association. As such, COVID testing should be done prior to imaging (Geyer, 2008; Lechien, 2020; Saniasiaya, 2020).**

POLICY HISTORY

Date	Summary
May 2021	**Updated References** **Reordered Indications** **Added hyperlinks to OTHER indications** **Orbit** **Added:** • **Complex strabismus to aid in diagnosis, treatment and/or surgical planning** • **If needed to confirm optic neuritis and rule out compressive lesions** **Clarified:** • **Documented visual defect if MRI is contraindicated or cannot be performed - *Unilateral or with abnormal optic disc(s) (i.e. Optic disc blurring, edema, or pallor);*** • **Clinical Suspicion of osteomyelitis: Direct visualization of bony deformity *OR* Abnormal X-rays** • ***Optic neuropathy* or unilateral optic disk swelling of unclear etiology (Combo Orbit/Brain CT)** **Sinus/Face**

	Added: • **Facial Trauma- For further evaluation of a known fracture for treatment or surgical planning** • **Dysosmia** **Clarified:** • **Sinonasal obstruction, suspected mass, *based on exam, nasal endoscopy, or prior imaging*** • **Note: CSF (cerebrospinal fluid) rhinorrhea - Sinus CT is indicated when looking to characterize a bony defect. CSF otorrhea - Temporal Bone CT is indicated. For intermittent leaks and complex cases consider CT/MRI/Nuclear Cisternography). CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)** **Deleted:** • **Trigeminal neuralgia – if Age < 40** **Neck** **Added:** • **Neck Mass or *lymphadenopathy* (non-parotid region or thyroid)** • **Unexplained ear pain when ordered by a specialist with all the following (Earwood, 2018)** o **Otoscopic exam, nasolaryngoscopy, lab evaluation (ESR, CBC) AND** o **Risk factor for malignancy ie tobacco use, alcohol use, dysphagia, weight loss OR age older than 50 years** • **Brachial Plexopathy (Vijayasarathi, 2016) if mechanism of injury or EMG/NCV studies are suggestive** **Note: Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury** **All** • Removed statement: A single authorization for CPT code 70540, 70542, or 70543 includes imaging of the Orbit, Face, Sinuses, and Neck. Multiple authorizations are not required
May 2020	**<u>Clarified</u>:**

	Orbit
	• **Ophthalmoplegia with concern for orbital pathology**
	• **Documented visual field defect if MRI is contraindicated or cannot be performed**
	• **Orbital or ocular mass/tumor, suspected or known**
	• **Clinical Suspicion of orbital infection**
	• **Clinical Suspicion of Orbital Inflammatory Disease (e.g., eye pain and restricted eye movement with suspected orbital pseudotumor)**
	Face/Sinus
	• **Suspected infection**
	  o **Osteomyelitis (after x-rays)**
	  o **Abscess**
	• **Facial Trauma**
	  o **Post traumatic CSF rhinorrhea (for CSF otorrhea Temporal Bone imaging is recommended)**
	• **Anosmia on objective testing that is persistent and of unknown origin (also in Brain and Sinus combo section)**
	Neck
	• **Neck mass (non-parotid or thyroid)**
	  o **Note: For discrete cystic lesions of the neck, an ultrasound should be performed as initial imaging unless there is a high suspicion of malignancy**
	• **MR Sialography to evaluate salivary ducts**
	• **Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course) (also in Brain and Neck combo section)**
	Combo - Brain and Orbit
	• **Reworded: Unilateral optic disk swelling/optic neuropathy of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders**
	• **Bilateral optic disk swelling (papilledema) with vision loss**
	<u>Added</u>:
	Orbit
	• **MRI is superior for the evaluation of the visual pathways, globe and soft tissues, CT is preferred for visualizing bony detail and calcifications**
	• **Unilateral optic disk swelling**
	• **Under documented visual field defect**
	  o **Unilateral or with optic disc abnormality**
	• **Congenital orbital anomalies**

	<u>Added</u>:
	Face/Sinus
	• **Examples of orbital or intracranial complications**
	  o **Preseptal, orbital, or central nervous system infection**
	  o **Osteomyelitis**
	  o **Cavernous sinus thrombosis**
	• **Face mass**
	  o **Known or highly suspected head and neck cancer on examination**
	• **Trigeminal neuralgia/neuropathy (for evaluation of the extracranial nerve course)**
	  o **If < 40 years of age or atypical features (e.g. bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution, progression)**
	<u>Added</u>:
	Neck
	• **Suspicious mass/tumor found on another imaging study and needing clarification**
	• **Under increased risk for malignancy**
	  o **History of cancer**
	  o **Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered of infectious cause**
	• **Neck Mass (parotid)**
	  o **Parotid mass found on other imaging study and needing further evaluation**
	<u>Added</u>:
	Neck
	• **Neck Mass (thyroid) - US is the initial imaging study of a thyroid region mass. CT is preferred over MRI in the evaluation of thyroid masses since there is less respiratory motion artifact**
	  o **Staging and monitoring for recurrence of known thyroid cancer**
	  o **To assess extent of thyroid tissue when other imaging suggests extension through the thoracic inlet into the mediastinum or concern for airway compression (Lin, 2016; Gharib 2016)**
	  NOTE: Chest CT may be included for preoperative assessment in some cases
	• **Pediatric patients (≤18 years old)**

	○ **Neck masses in the pediatric population if ultrasound is inconclusive or suspicious** ○ **History of malignancy** **<u>Added</u>:** **Neck** • **Known or suspected deep space infections or abscesses of the pharynx or neck** **Combo** • **Known tumor or cancer of skull base, orbits, sinuses, face, tongue, larynx, nasopharynx, pharynx, or salivary glands** ○ **Surveillance appropriate for tumor type and stage** • **For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology** **<u>Added</u>:** **Combo** • **Added sub Combo sections** ○ **Brain and Orbit** ▪ **Optic Neuritis if atypical presentation, severe visual impairment or poor recovery following initial onset or treatment onset** ○ **Brain and Sinus** ○ **Brain and Neck** **<u>Deleted:</u>** **Orbit** • **Unilateral optic disk swelling papilledema approve dedicated Orbits MRI even if Brain MRI approved** **<u>Deleted:</u>** **Face/Sinus** • **Clinical Suspicion of osteomyelitis** ○ **Direct visualization of lesion over bone** ○ **Abnormal x-ray** • **Face Mass** ○ **Prior history of tumor with suspicion of recurrence** • **Facial trauma** ○ **Suspected orbital trauma with indeterminate x-ray or ultrasound** **Neck** • **Palpable from Palpable suspicious lesions in mouth or throat** • **Salivary gland stones or clinical concern for abscess** • **Thoracic Outlet Syndrome**

	Combo • **Trigeminal neuralgia** • **Cranial neuropathy (weakness or sensory abnormalities of the head and neck**
July 2019	**<u>ORBIT MRI:</u>** • **Removed: Orbital asymmetry and Suspected hyperthyroidism (such as Graves' disease)** • **Added: Clinical suspicion of osteomyelitis** **<u>Face/Sinus MRI</u>** • **Added specifics to Face Mass:** o **Present on physical exam and remains non-diagnostic after x-ray or ultrasound is completed (Kuno, 2014)** o **Clinical concern for abscess** o **Failed 2 weeks of treatment for suspected infectious adenopathy (Haynes, 2015).** o **Prior history of tumor with suspicion of recurrence** • **Added: Facial trauma with physical findings of direct facial bone injury; suspected orbital trauma w/indeterminate x-ray or US; CSF leak (rhinorrhea or otorrhea)** **<u>Other Indications</u>** • **Added: Suspected recurrence or new metastases based on symptoms or examination findings with new mass or change in lymph nodes; Anosmia on objective testing; Trigeminal neuralgia if <40 years of age or atypical features; Objective cranial nerve palsy; and Granulomatosis with polyangiitis (Wegener's granulomatosis) disease** **Indications for combo studies orbit/face/sinus neck MRI with brain MRI** • **Added: Bilateral papilledema with vision loss AND Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **PELVIS MRI**	**Original Date: September 1997**
CPT Codes: 72195, 72196, 72197, +0698T	**Last Revised Date: April 2021**
Guideline Number: NIA_CG_037	**Implementation Date: January 2022**

Note: There is no MRI Abdomen/Pelvis combo (comparable to a CT Abdomen/Pelvis) such that if imaging of both the abdomen and pelvis are indicated, two separate exams (and authorization) are required (i.e., MRI Abdomen and MRI Pelvis)

INDICATIONS FOR PELVIC MRI (Click here for Fetal MRI indications)

Initial pelvic imaging for staging of prostate cancer

- **High Risk and above (T3a or higher, PSA >20*, Gleason 8-10)**
- **Intermediate Risk (T2b-T2c or PSA 10-20* or Gleason 7) when Nomogram predicts >10% probability of lymph node involvement (MSKCC/Kattan is the nomogram recommended by NCCN 2021)**

***In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (i.e., PSA 6 on finasteride adjusts to a PSA of 12)**

Known prostate cancer for workup of recurrence and response to treatment
(NCCN, 2019)

- Initial treatment by active surveillance (asymptomatic very low, or low or intermediate risk with expected patient survival ≥ 10 years):
  - Initial multiparametric MRI (mpMRI) for patients who chose active surveillance
  - mpMRI to be repeated no more than every 12 months unless clinically indicated
- Initial treatment by radical prostatectomy:

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

    - Failure of PSA to fall to undetectable level or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment radiation therapy:
    - Post-radiation therapy (Post-RT) rising PSA or positive digital exam and is candidate for local therapy

Indication for prostate MRI (suspected prostate cancer)
(**Bjurlin, 2018, 2020; Borofsky, 2018; EAU, 2018; Elkhoury, 2019; NCCN, 2021)**

- **Prior to prostate biopsy when notes indicate that biopsy is planned (Alexander, 2019)**
- **In individuals with previous negative biopsy and ongoing concerns of increased risk of prostate cancer (i.e., rising or persistent elevated PSA with lab reports on 2 or more separate days OR suspicious digital rectal exam (DRE))**

Note: Prostate MRI should not replace biopsy nor be used to determine if biopsy is necessary.

Evaluation of suspicious or known mass/tumors

- Initial evaluation of suspicious pelvic masses/tumors found only in the pelvis by physical exam and ultrasound has been performed (ACR, 2013, 2014)
- Further evaluation of abnormality seen on ultrasound (US) or when US is inconclusive (ACR, 2013, 2014)
- **Surveillance: One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance MR unless tumor(s) are specified as highly suspicious or change was found on exam or last follow-up imaging.**
- Initial staging of known cancer
- Follow-up of known cancer (Bourgioti, 2016; **NCCN, 2019**):
    - **Of** patient undergoing active treatment within the past year
    - **With** suspected pelvic metastasis based on a sign, symptom, **(e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding)** or an abnormal lab value **(alpha-fetoprotein, CEA, CA 19-9, p53 mutation**)

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 suspected infection or inflammatory disease after preliminary imaging (such as CT, US, or nuclear medicine) has been performed or is contraindicated (includes MR urography (MRU) which includes abdomen MRI when indicated)
(ACR, 2013; Cartwright, 2015)

- Suspected perianal fistula
- Suspected infection (based on elevated WBC, fever, anorexia, or nausea and vomiting) in the pelvis

- For suspected urethral stricture or periurethral pathology (Aldamanhori, 2018)

For evaluation of known infection or inflammatory disease follow-up
(ACR, 2013, 2014; Vogel, 2016)
- Any known infection that is clinically suspected to have created an abscess in the pelvis and preliminary imaging has been performed or is contraindicated
- Any history of fistula limited to the pelvis that requires re-evaluation or is suspected to have recurred
- For patients with recurrent fistula-in-ano or perianal Crohn's disease
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation and is limited to the pelvis

For evaluation of suspected inflammatory bowel disease or follow-up (includes MR enterography and can also approve Abdomen MRI/MRE)
- For suspected **inflammatory bowel disease** (Crohn's disease **or ulcerative colitis**) with abdominal pain **AND one of the following (ACR, 2019; Arif-Tiwari, 2019; Lichtenstein, 2018):**
    - Chronic **diarrhea**
    - **B**loody diarrhea
- **H**igh clinical suspicion after complete work up including physical exam, labs, endoscopy with biopsy (ACR, 2019; Arif-Tiwari, 2019; Lichtenstein, 2018; **Rubin, 2019**)
- For MR enterography (MRE) if CT or MRI of the abdomen and pelvis are inconclusive
- Known inflammatory bowel disease (Crohn's or ulcerative colitis) with signs/symptoms **(e.g., abdominal pain, diarrhea, or hematochezia**) requiring re-evaluation, or for monitoring therapy (ACR, 2019)

For suspected or known hernia
- For pelvic pain due to a suspected occult, spigelian, or incisional hernia when physical exam **and** prior imaging are non-diagnostic or equivocal or if requested as a preoperative study
    - For confirming diagnosis of a recurrent hernia when ultrasound is negative or nondiagnostic
    - **Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain, or guarding), physical exam (guarding, rebound) or prior imaging (Halligan, 2018).**

- **Suspected athletic pubalgia (sports hernia) in a patient with persistent groin pain that occurs with exertion, who has not responded to conservative treatment for four weeks, when other imaging is inconclusive (Lee, 2017; Paksoy, 2016).**

Indications for Musculoskeletal Pelvic MRI

- Initial evaluation of suspicious mass/tumor of the bones, muscles or soft tissues of the pelvis found on an imaging study, and needing clarification, or found by physical exam and after x-ray or ultrasound **is completed**
- Evaluation of suspected fracture and/or injury when initial imaging is **completed** or for confirmed stress (fatigue) fracture for "return to play" evaluation (ACR, 2016)
- For evaluation of known or suspected aseptic/avascular necrosis of hip(s) after completion of initial x-ray (ACR, 2015)
- **Known or suspected** sacroiliitis (infectious or inflammatory) after **abnormal** x-ray (ACR, 2016; Jans, 2014)
- Sacroiliac Joint Dysfunction when there is (Jans, 2014):
    - Persistent back and/or sacral pain unresponsive to four (4) weeks of conservative treatment, received within the past six (6) months, including physical therapy or physician supervised home exercise plan (HEP)
- For evaluating the lumbosacral plexus (ACR, 2016; Muniz-Neto, 2018):
    - To confirm involvement in symptomatic patients with known tumor
    - To assess extent of injuries in the setting of pelvic trauma
    - To exclude the presence of masses in patients with unilateral changes, or inconclusive or abnormal findings on EMG when there are persistent symptoms
    - For evaluation when lumbar spine MRI is suspicious or indeterminate
- For suspicion of pudendal neuralgia in the setting of chronic pelvic pain with genital numbness and erectile dysfunction when other causes have been ruled out (see Background regarding diagnosis) (Wadhwa, 2016)
- For suspicion of meralgia paresthetica when prior testing is inconclusive (diagnostic nerve block; electrodiagnostic testing; AND somatosensory evoked potentials) (Ally, 2019; Cheatham, 2013)
- Persistent Pain:
    - For evaluation of persistent pain unresponsive to four (4) weeks of conservative treatment received within the past six (6) months
    - For suspected piriformis syndrome after failure of 4 weeks conservative treatment (Hoon Ro, 2018)
- For further evaluation of congenital anomalies of the sacrum and pelvis and initial imaging has been performed

Other Indications for a Pelvic MRI

- **Pelvic pain not explained by previous imaging/preprocedure (ACR, 2018)**
    - **Appropriate laboratory testing (chemistry profile, complete blood count, and urinalysis) and initial imaging, such as ultrasound**
- For location or evaluation of undescended testes in adults and in children, including determination of location of testes, if ordered by a specialist (Kolon, 2014)
- For evaluation and characterization of uterine and adnexal masses, (e.g., fibroids, ovaries, tubes, and uterine ligaments) or congenital uterine or renal abnormality where ultrasound has been done previously (ACR, 2018).

- **For evaluation of abnormal uterine bleeding when ultrasound findings are indeterminate (ACR 2020)**
    - **Age ≤ 50 – Vascular stalk or focal doppler signal on US**
    - **Age > 50 – Thickened endometrium, vascular stalk or focal doppler signal on US**
- For evaluation of uterus prior to and after embolization (MRA preferred) (Deshmukh, 2012).
- For evaluation of endometriosis when preliminary imaging has been completed or to follow up known endometriosis (ACR, 2012; Siegelman, 2012)
- **For further evaluation of suspected adenomyosis when ultrasound is inconclusive (Cunningham, 2018), such as the following:**
    - **Uterine abnormality on US**
        - **Anechoic spaces/cysts in myometrium**
        - **Heterogeneous echotexture**
        - **Obscured endometrial/myometrial border**
        - **Sub-endometrial echogenic linear striations**
        - **Thickening of the transition zone**
        - **Uterine enlargement**
        - **Uterine wall thickening**
- Prior to uterine surgery if there is abnormality suspected on prior ultrasound
- For suspected placenta accreta or percreta when ultrasound is indeterminate (Kilcoyne, 2017)
- For further assessment of a scrotal or penile mass when ultrasound is inconclusive (Kirkham, 2012; Parker, 2015)
- For investigation of a malfunctioning penile prosthesis
- Suspected urethral diverticula and other imaging is inconclusive (Dwarkasing, 2011) **(MRI may be indicated without prior ultrasound in limited situations as suggested, such as when there is compelling evidence suggestive of urethral diverticulum (i.e. ostia on cystoscopy or tender cystic lesion on anterior vaginal wall overlying the urethra) or for surgical planning.)**
- For suspected pelvic congestion syndrome in **women** with chronic pelvic pain when other imaging is non-diagnostic (Knuttinen, 2015)
- For suspected patent urachus or other urachal abnormalities when ultrasound is **non**-diagnostic (Buddha, 2019; Villavicencio, 2016)
- For evaluation of suspected pelvic floor weakness in women with functional disorders, such as urinary or fecal incontinence, obstructed defecation, and pelvic organ prolapse (Garcia del Sato, 2014)
- MR defecography for suspected structural cause of defectory outlet obstruction to confirm diagnosis if other testing is equivocal (anorectal manometry and balloon expulsion testing) (Wald, 2014)
- For evaluation of enlargement of organ abnormality seen on previous imaging - to provide an alternative to an indeterminate or inconclusive ultrasound
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound
- For May-Thurner syndrome (MRV preferred)

- For further evaluation of an isolated right varicocele with additional signs and symptoms that suggest malignancy or suspicious prior imaging findings (Gleason, 2019)
- Surveillance MRI (include abdomen) every 2-3 years for patients with Hereditary Paraganglioma syndromes Type 1-5 (Benn, 2015)
- In hematospermia in men over 40, if **t**ransrectal ultrasound is negative or inconclusive (Allen, 2017)

Pre-operative evaluation
- For diagnostic purposes prior to pelvic surgery or procedure

Post-operative/procedural evaluation
- Follow-up of known or suspected post-operative complication involving the hips or the pelvis (Davis, 2016; Yanny, 2012) within six months
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Note: If an Abdomen/Pelvis MRI is indicated and the Abdomen MRI has already been approved, then the Pelvis MRI may be approved.

Fetal MRI (CPT codes 74712-74713) - To better define or confirm a known for suspected abnormality of the fetus after ultrasound has been performed during the second trimester (Prayer, 2017) or when fetal surgery is planned and/or to make a decision about therapy, delivery or to advise the family about prognosis (ACR-SPR, 2015; SPR, 2011). Also includes evaluation of the maternal pelvis and placenta.

BACKGROUND

Magnetic resonance imaging of the pelvis is a noninvasive technique for the evaluation, assessment of severity, and follow-up of diseases of the male and female pelvic organs. MRI provides excellent contrast of soft tissues and provides multiplanar and 3D depiction of pathology and anatomy. Patients undergoing MRI do not have exposure to ionizing radiation or iodinated contrast materials. MRI techniques utilize body coils to image the entire pelvis or endoluminal coils for evaluation of the rectum, prostate, and genitourinary system.

OVERVIEW

PI-RADS Assessment Categories for Prostate Cancer:

(ACR, 2019)

The assignment of a **PI**-RADS category is based on mpMRI findings only and does not incorporate other factors, including PSA testing, DRE (digital rectal exam), or clinical history.

PIRADS 1 – Very low (clinically significant cancer is highly unlikely to be present)
PIRADS 2 – Low (clinically significant cancer is unlikely to be present)
PIRADS 3 – Intermediate (the presence of clinically significant cancer is equivocal)
PIRADS 4 – High (clinically significant cancer is likely to be present)
PIRADS 5 – Very high (clinically significant cancer is highly likely to be present)

***Conservative Therapy** - **Conservative therapy** 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 chiropractic care.

****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 **4**-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.

MRI and Undescended Testes – The most common genital malformation in boys is undescended testis. In one series, 70% of undescended testes are palpable. **D**espite the advances in ultrasound technology, ultrasound cannot reliably identify intra-abdominal testes, which comprise 20% of all undescended testes (Tasian, 2011). The timely management of undescended testis is important to potentially minimize the risk of infertility and lessen the risk of malignancy. MRI is used as a diagnostic tool in the detection of undescended testes and can reveal information for both anatomic and tissue characterization. It is noninvasive, non-ionizing, and can obtain multiplanar images.

MRI and Adnexal Masses – MRI is used in the evaluation of adnexal masses. It can identify and characterize different neoplastic and nonneoplastic abnormalities, e.g., exophytic leiomyoma, endometrioma, dermoid cyst, and ovarian edema. It is a useful adjunct when sonography is inconclusive in the evaluation of adnexal masses.

MRI and Endometriosis – MRI manifestations of endometriosis vary including endometrioma, peritoneal endometrial implant, adhesion, and other rare features. The data obtained from imaging must be combined with clinical data to perform preoperative assessment of endometriosis.

MRI and Lumbosacral Plexopathy - Complete lumbar (L1-L4) or sacral plexopathy (L5-S3) may present with weakness, sensory loss, and flaccid loss of tendon reflexes. Clinical diagnosis is confirmed by EMG. Acute and chronic plexopathies may be caused by nerve sheath tumors; infectious, autoimmune, hereditary, or idiopathic neuropathies; extrinsic compression; or trauma (ACR, 2016). There is no CPT® code specifically for imaging of the LS plexus. Pudendal neuralgia may be considered in chronic pain patients who meet the Nantes criteria: pain in the area innervated by the pudendal nerve, pain more severe with sitting, pain that does not awaken the patient from sleep, pain with no objective sensory impairment, and pain relieved by pudendal block. All five criteria must be met for diagnosis (Wadhwa, 2016).

MRI and Prostate Cancer – Although prostate cancer is the second leading cause of cancer in men, **most** cases do not lead to a prostate **cancer**-related death. Aggressive treatment of prostate cancer can have side effects, such as incontinence, rectal injury, and impotence. It is very important to do an evaluation **that** will assist in making decisions about therapy or treatment. MRI can non-invasively assess prostate tissue, functionally and morphologically. MRI evaluation may use a large array of techniques, e.g., T1-weighted images, T2-weighted images, and dynamic contrast enhanced T1-weighted images.

Prostate Cancer – MRI is not recommended in patients with suspected cancer but prior negative biopsy because MRI alone can miss up to 26% of clinically significant cancers that would be detected on TRUS biopsy (Borofsky, 2018). Patients with suspected prostate cancer should first undergo a systematic biopsy and if that fails to demonstrate tumor, an MRI can then be obtained to guide future biopsy attempts (Bjurlin, 2018; **Elkhoury**, 2019).

Per NCCN, 2019, for asymptomatic patients with prostate cancer, in very low, low, or intermediate groups with life expectancy ≤ 5 years, no further treatment or **work**-up indicated (unless the patient becomes symptomatic). Active surveillance is indicated if life expectancy is determined to be ≥ 10 years.

MRI and Rectal Cancer – MRI is used in the evaluation of rectal cancer to visualize not only the intestinal wall but also the surrounding pelvic anatomy. MRI is an excellent imaging technique due to its high soft-tissue contrast, powerful gradient system, and high resolution. It provides accurate evaluation of the topographic relationship between lateral tumor extent and the mesorectal fascia.

Imaging of hernias—Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a **first**-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT (Robinson, 2013). According to Miller et al, “Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…” (Miller, 2014). Both MRI and US can be valuable for diagnosing pathology in athletes with groin pain when a sports

hernia is suspected. Pain usually occurs with exertion with tenderness over the pubic symphysis or tubercle and exquisite tenderness on direct palpation of the superficial inguinal ring (positive direct stress test).This term initially denoted a posterior inguinal wall deficiency due to disruption of fascia and/or muscle but more recently given the label "core injury" to also include adductor tendon tears, injury to the aponeurosis of the rectus abdominus and adductor longus tendons, and osteitis pubis (Lee, 2017).

Elevated CA-125 and pelvic imaging- There is no evidence that isolated levels of CA-125 with no other clinical or radiologic evidence of pathology is sensitive or specific and should not be performed as an isolated test as it can lead to unnecessary studies and anxiety. It is elevated in most cases of epithelial ovarian cancer and is used in monitoring response to treatment as an adjunct to pelvic US. **CA**-125 has been shown to be increased **in many conditions such as** fibroids, adenomyosis, pancreatic cancer, endometriosis, tuberculosis, and interstitial lung disease. MRI is not indicated as a **first**-line test (Tahmasebi, 2018).

POLICY HISTORY

Date	Summary
July 2021	• **Clarified language in Indication for prostate MRI (suspected prostate cancer) based on updates to Version 2.2021 NCCN guidelines and 2020 publication of updated AUA-SAR SOPs regarding MRI**
April 2021	• **Updated the initial imaging for prostate cancer to reflect 2021 NCCN changes and "adjusted PSA"** • **Revised indication for prostate MRI (suspected prostate cancer) to clarify criteria related to a negative prior biopsy and added criteria for when imaging is appropriate prior to biopsy** • **Included criteria for ultrasound abnormalities for adenomyosis** • **Added limited circumstances when prior imaging is not needed before MRI for the evaluation of urethral diverticula**
May 2020	• **Mention MRU which includes MRI abd** • **Perianal fistula including with Crohn's** • **Urethral eval** • **Added section on MRE for IBD** • **Added section on Lumbosacral plexus, pudendal neuralgia, maralgia paresthetica, piriformis syndrome** • **Added separate section on hernia including sports hernia** • **Added abnormal uterine bleeding; adenomyosis; pelvic floor weakness; urachal anomalies; MR defecography; surveillance for**

	paraganglioma syndromes; hematospermia; LE edema; right varicocele; May-Thurner • **Added the Fetal MR GL to page** • **Comment section on Lumbar plexopathy, sports hernia, elevated CA-125**
June 2019	● **Added the following indications:** o **rising or persistent elevated PSA OR suspicious DRE and at least 15 yr life expectancy and negative prior biopsy** o **suspected perianal fistula** o **6 months time specification for f/u of known or suspected post-operative complication involving hips or pelvis** o **for confirmed stress (fatigue) fracture for "return to play" evaluation** o **post operative complications after pelvic floor surgery** o **For known prostate cancer: Initial treatment by active surveillance w/initial mpMRI and mpMRI to be repeated no more than every 12 months unless clinically indicated** o **suspected placenta accrete or percreta when US is indeterminate** o **further assessment of a scrotal or penile mass when ultrasound is inconclusive** o **investigation of a malfunctioning penile prosthesis** o **suspected urethral diverticula and other imaging is inconclusive** o **evaluation of adenomyosis when ultrasound is equivocal, especially in the case of suspected focal adenomyoma when it will help determine if surgery is indicated** o **suspected pelvic congestion syndrome in patients with chronic pelvic pain when other imaging is non-diagnostic** o **suspected patent urachus when ultrasound is non diagnostic** o **evaluation of enlargement of organ abnormality seen on previous imaging - to provide an alternative to an indeterminate or inconclusive ultrasound** o **PI-RADS information to background section** o **Home exercise program information updated to include dates and duration of failed PT and other**

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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.

AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines LUMBAR SPINE MRI	Original Date: September 1997
CPT Codes: 72148, 72149, 72158, +0698T	Last Revised Date: April 2021
Guideline Number: NIA_CG_044	Implementation Date: January 2022

INDICATIONS FOR LUMBAR SPINE MRI

(Combination requests at end of the document)

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

- **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 1 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)**

For evaluation of back pain with any of the following
(AAFP, 2012; ACEP, 2014; ACR, 2015; Allegri, 2016; Ammendolia, 2015; Jarvik, 2015; Last, 2009; NASS, 2013; Quaseem, 2017; Schneider, 2019)

- **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**

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 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 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 (x-ray or CT) needing further evaluation**

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

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)**

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
(ACR, 2018)

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

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

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 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 (ACR, 2018; Ziu, 2020)**

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 (ACR, 2018)**

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

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

For evaluation of known or suspected infection, abscess, or inflammatory disease (ACR, 2015; Lerner, 2018)

- **Infection**
  - **As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings (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)**
- **Spondyloarthropathies**
  - **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 (ACR, 2018)

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

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

- **Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata (AANS, 2019; Duz, 2008; Milhorat, 2009)**
- **Known anorectal malformations (Kim, 2010a; 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 (Arnold-Chiari syndrome), 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)**

COMBINATION OF STUDIES WITH LUMBAR SPINE MRI

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 MRIs

- **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, 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))**
- **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)**
- **Suspected 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))**

BACKGROUND

Magnetic resonance imaging (MRI) is used in the evaluation, diagnosis, and management of **spine**-related conditions, e.g., degenerative disc disease, cauda equine compression, radiculopathy, infections, or cancer in the lumbar spine. MRI provides high quality multiplanar images of organs and structures within the body without the use of x-rays or radiation. In the lumbar area where gonadal exposure may occur, MRI's lack of radiation is an advantage.

OVERVIEW

Ankylosing Spondylitis/Spondyloarthropathies is a cause of back or sacroiliac pain of insidious onset (usually > 3 month**s**), 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; S**ie**per, 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

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)

***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.

****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 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 • 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.		

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**

MRI and Back Pain – MRI is the initial imaging modality of choice in the evaluation of complicated low back pain. Contrast administration may be used to evaluate suspected inflammatory disorders, e.g., discitis, and it is useful in evaluating suspected malignancy. Radiculopathy, disease of the nerve roots, is the most common indication for MRI of patients with low back pain. The nerve roots become irritated and inflamed, due to direct pressure from degenerative changes in the lumbar spine, creating pain and numbness. Symptoms of radiculopathy also include muscle weakness. MRI is indicated for this condition if the symptoms do not improve after conservative treatment over six weeks. MRI is also performed to evaluate Cauda equina syndrome, severe spinal compression.

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).**

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

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

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

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. 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**s** can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process (Ziu, 2019).

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

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**, 2017).
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement only after age 1 and is recommended in patients <1 year only if symptomatic (Comi, 2011).

POLICY HISTORY

Date	Summary
April 2021	• **Added/modified** o **Modified section on neurological deficits** o **Back pain in a child added/modified red flags** o **Gait table in background** o **Post-surgical modified/clarified surgical criteria for combination exams** o **Removed myelopathy combination studies** o **Updated/added MS Criteria** ▪ **Combination section for initial imaging and follow up** ▪ **Added pediatric MS** o **Modified known tumor imaging into primary and metastatic disease** o **Added toe walking for pediatric patients** o **Modified Combination exam wording**
May 2020	• **Added:** o **For evaluation of neurologic deficits added new deficits** o **Added ankylosing spondylitis for evaluation of trauma/acute injury** o **Added follow up of osteoperotic fracture from metastatic disease** o **Added Osteopathic Manipulative medicine to conservative care therapy** o **Added suspected leptomeningeal carcinomatosis to combination spine imaging** o **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**

	o **Modified Pars fracture to not seen on radiograph and imaging would change management** o **Added spina bifida occulta to background section**
June 2019	• **Added:** o **new or worsening objective neuro deficits for chronic and acute back pain** o **CSF leak** o **last 6 months for allowable post op f/u period and removed EMG comment** o **red flags specifically for peds back pain and pain related to malignancy, infection, inflammation** o **new sections: pars defect; compression fractures; congenital abnormalities including section on scoliosis and vertebral anomalies in children w/back pain;** o **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** • **Expanded on tethered cord in Other Indications for imaging and added section on sacral dimple**

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Reviewed / Approved by NIA Clinical Guideline Committee

GENERAL INFORMATION

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