



For Providers & Practice Staff

# CT and MRI Guide

## Indication and Selection of Imaging Modality

# CT and MRI Imaging Tests

The highly trained, subspecialized radiologists at Bronson are dedicated to the safe and efficient use of advanced imaging to help improve the health of patients. When appropriately applied, advances in imaging technology enable the early detection of disease that can lead to improved treatment options and outcomes.

CT and MRI Appointments can be scheduled at Bronson locations throughout Southwest Michigan. For a list of locations with all your imaging needs, go to [bronsonhealth.com](http://bronsonhealth.com).

- Battle Creek: **(269) 245-8666**
- Kalamazoo and Paw Paw: **(269) 341-8700** or **(888) 741-6415**
- South Haven: **(269) 639-2828**

If you have specific questions about CT or MRI exams, please call **(269) 341-6380**.

Please note: the information provided in this guide is not intended to be all inclusive. Clinical judgment in an individual case may influence the choice of imaging modality.

# Scheduling "Tips and Tricks"

## CT

### Contrast Options:

- With
- Without
- Without and With – part of the procedure will performed without contrast and part with contrast.

Note: Any CT to be performed with contrast should be ordered as "With" only, not "Without and With"

### Common Risk Factors Requiring Labs:

- Diabetes
- 60 Years or Older
- Cardiovascular Disease or High Blood Pressure
- Kidney Problems

### GFR Guidelines for Hydration:

- GFR > 60: No hydration
- GFR between 60-51: Oral hydration
- GFR < 50: IV hydration - at radiologist discretion

### Patient/Equipment Weight Limit:

- 500 lbs. (BMH),(BBC),(BSH)
- 450 lbs. (BARS),(BLH),(BBC-OC)

### CT Colonography and CT Coronary procedures:

- Scheduled by the Bronson Hospital CT Dept. staff:  
Call (269)341-8707 for CT Colonography and CT Coronary procedures

### Age Requirements:

- Greater than 10 years old (BLH),(BARS),(BSH)
- For BMH:
  - 0-2 years old requires sedation
  - 2-18 years old (Pediatric) Sedation **dependent on patient's condition**

## MRI

### Common Risk Factors Requiring Labs:

- Diabetes
- 60 Years or Older
- High Blood Pressure
- Kidney Problems

### Primary reasons to use **Without** and **With** Contrast:

- Infection
- Mass
- Lesion

### Age Requirements:

- Greater than 10 years old (BARS, BLH, BBC, BSH and mobiles)
- For BMH:
  - 0-8 years old requires sedation

### Patient/Equipment Weight Limit:

- 550 lbs. (BARS),(BLH),(BMH),(BSH)
- 500 lbs. (BBC),(BBC-OC)
- 350 lbs. (BSH)

### Equipment:

- 3T – (BARS),(BBC),(BMH)
- 3T Wide Bore (BARS), 1.5 Wide Bore (BLH)
- 1.5T Wide Bore – (BBC-OC),(BSH)

#### **Key**

BARS:	Bronson Advanced Radiology Services
BBC:	Bronson Battle Creek
BLH:	Bronson LakeView Hospital
BMH:	Bronson Methodist Hospital
BBC-OC:	Bronson Battle Creek Outpatient Center – Beckley Road Imaging
BSH:	Bronson South Haven

BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>BRAIN</b> *If MRI is contraindicated then CT	• <b>Acoustic Neuroma (see also Vestibular Schwannoma)</b>	<b>MRI</b>	<b>Without &amp; With</b>	Ct more useful in assessing the osseous temporal bone.
	• <b>Acute Bleed</b>	<b>CT</b>	<b>Without</b>	
	• <b>Brain tumor, metastasis</b>	<b>MRI</b>	<b>Without &amp; With</b>	May add perfusion & spectroscopy to better characterize known mass.
	• <b>Cavernous sinus</b>	<b>MRI</b>	<b>Without &amp; With</b>	MRI brain/sella
	• <b>CNS infection, abscess, meningitis</b>	<b>MRI</b>	<b>Without &amp; With</b>	
	• <b>Cranial nerves</b>	<b>MRI</b>	<b>Without &amp; With</b>	Protocols to evaluate either upper or lower cranial nerves
	• <b>Dementia or Movement Disorders</b>	<b>MRI</b>	<b>Without</b>	MRI superior evaluation of white matter changes, patterns of atrophy.
	• <b>Headache</b>	<b>MRI or CT</b>	<b>Without</b>	MRI preferred unless headache suspected due to acute hemorrhage or dissection. Contrast for meningeal disease or suspected mass.
	• <b>Hearing loss, conductive</b>	<b>CT</b>	<b>Without</b>	Assesses mastoids, middle ear, ossicles
	• <b>HIV</b>	<b>MRI</b>	<b>?</b>	
	• <b>Inflammation, known malignancy</b>	<b>MRI</b>	<b>Without &amp; With</b>	
	• <b>Multiple Sclerosis</b>	<b>MRI</b>	<b>Without &amp; With</b>	Consider imaging of both the brain and spine
	• <b>Neurodegenerative Disorder</b>	<b>MRI</b>	<b>Without</b>	Parkinson's Disease etc.
	• <b>Optic nerves</b>	<b>MRI or CT</b>	<b>Without &amp; With</b>	<ul style="list-style-type: none"> <li>• <b>MRI</b> for evaluation of optic neuritis or orbital mass.</li> <li>• <b>CT</b> for calcification in optic nerve meningioma</li> </ul>
	• <b>Orbit-Proptosis</b>	<b>CT or MRI*</b>	<b>With</b>	No contrast for Graves' Disease
	• <b>Pituitary tumor</b>	<b>MRI*</b>	<b>Without &amp; With</b>	MRI better for characterizing sellar mass & assessing extent.
	• <b>Posterior Fossa, brain stem lesion</b>	<b>MRI*</b>	<b>Without &amp; With</b>	MRI far superior in this region
	• <b>Seizure</b>	<b>MRI*</b>	<b>"?"</b>	May require contrast for adults
	• <b>Stroke</b>	<b>CT or MRI</b>	<b>Without</b>	CT typically first exam. MRI more sensitive. Consider vascular imaging with CTA or MRA.
	• <b>Subarachnoid bleed</b>	<b>CT</b>	<b>Without</b>	
	• <b>Subdural hematoma</b>	<b>CT or MRI</b>	<b>Without</b>	CT is first examination. MRI to evaluate for blood of different ages.
• <b>TIA</b>	<b>MRI</b>	<b>Without</b>	Contrast helpful if sub-acute ischemia suspected.	
• <b>Tinnitus (pulsatile)</b>	<b>CT or MRI</b>	<b>With</b>	CT better for assessing osseous temporal bone, MRI for soft tissue skull base findings.	
• <b>Vestibular Schwannoma, Sensorineural hearing loss</b>	<b>MRI</b>	<b>Without &amp; With</b>	Ct more useful in assessing the osseous temporal bone.	

BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>NEURO-VASCULAR</b> *If MRI is contraindicated then CT or CTA	• Aneurysm	<b>MRA</b> or <b>CTA</b>	<b>Without</b> <b>With</b>	• MRA useful for screening. CTA more sensitive, particularly for aneurysms 3 mm in size or less.
	• Circle of Willis	<b>MRA*</b>  <b>MRV*</b> <b>CTA</b>	<b>Without</b>  <b>Without</b> <b>With</b>	• For intracranial circulation • For cervical vessels • For intracranial veins & dural venous sinuses • In general more sensitive than MRA for dissection or aneurysm. Downside is radiation exposure.
	• Venous sinus thrombosis	<b>MRI, MRV</b>	<b>Without</b>	
<b>FACE &amp; NECK</b>	• Facial trauma	<b>CT</b>	<b>Without</b>	
	• Neck mass	<b>CT 1<sup>st</sup> then</b>  <b>MRI*</b>	<b>With</b>  <b>Without &amp; With</b>	<b>CT first</b> examination in most cases, including adenopathy and suspected or palpable mass. <b>MRI</b> for perineural disease extension, residual/ recurrent malignancy in some cases, or suspected cartilage invasion.
	• Salivary gland	<b>CT</b>	<b>With</b>	
	• Sinusitis	<b>CT</b>	<b>Without</b>	CT defines ostial obstruction, bone changes
	• Skull base	<b>CT or</b>  <b>MRI</b>	<b>With</b>  <b>Without &amp; With</b>	CT preferred for osseous detail. MRI preferred for skull base mass or soft tissue characterization.
	• Squamous CA	<b>CT 1<sup>st</sup> then</b> <b>MRI</b>	<b>With</b> <b>Without &amp; With</b>	
	• TMJ	<b>MRI</b>	<b>Without</b>	
	• Vocal chord paralysis	<b>CT 1<sup>st</sup> then</b> <b>MRI</b>	<b>With</b> <b>With</b>	
<b>SPINE</b> MRI for patients with previous lumbar surgery - order <b>without &amp; with contrast</b> .	• Compression fx, Possible bone metastasis	<b>MRI</b>	<b>Without (Fracture)</b> <b>Without &amp; With (Mets)</b>	In most cases, better characterization of focal or diffuse marrow process with MRI. CT adjunctive in some cases.
	• Cord disease	<b>MRI</b>	<b>Without &amp; With</b>	Demyelination, syrinx
	• Cord tumor	<b>MRI</b>	<b>Without &amp; With</b>	
	• Discitis/Osteomyelitis	<b>MRI</b>	<b>Without &amp; With</b>	
	• Herniated disc, cervical or thoracic	<b>MRI</b>	<b>Without</b>	Contrast not necessary for most C or T spine
	• Herniated disc, lumbar	<b>MRI</b>	<b>Without (Unless prev. back surgery)</b>	Contrast essential to distinguish scar from recurrent disc herniation after surgery

BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>SPINE Cont'd</b>	• <b>Metastasis; bone, epidural, intraspinal</b>	<b>MRI</b>	<b>Without &amp; With</b>	Non-contrast adequate for bone metastasis. Contrast for epidural or intrathecal tumor
	• <b>Stenosis</b>	<b>MRI</b>	<b>Without</b>	
<b>MUSCULO-SKELETAL</b>	MRI is generally the preferred modality for suspected musculoskeletal pathology and is the preferred study for joint, tendons, ligament, and cartilage pathology. It is also the preferred modality in the detection of most stress injuries and occult fracture in patients with osteopenia or osteoporosis. CT, CT arthrography, and ultrasound can often be substituted if MRI is contraindicated due to pacemaker or other issues and can often be complementary examinations. In specific cases, CT or Ultrasound may be preferred. Contact a musculoskeletal radiologist with any questions at (269) 341-6380			
	• <b>Ankle - ligament or tendon pathology</b>	<b>MRI</b>	<b>Without</b>	
	• <b>Arthroplasty evaluation</b>	<b>CT or MRI</b>	<b>Without</b>	Specific total arthroplasty protocols available for MRI optimal for detecting early synovitis/particle disease.
	• <b>Avascular necrosis</b>	<b>MRI</b>	<b>Without</b>	
	• <b>Bone lesions -indeterminate on MRI, plain film, or bone scintigraphy</b>	<b>CT</b>	<b>Without</b>	May be complementary.
	• <b>Brachial plexus - suspected pathology</b>	<b>MRI</b>	<b>Without</b>	Use contrast if suspected malignancy
	• <b>Elbow - suspected ligament pathology</b>	<b>MRI</b>	<b>Without (intra-articular)</b>	MR arthrography
	• <b>Elbow-suspected tendon pathology</b>	<b>MRI</b>	<b>Without</b>	Include FABS views for suspected biceps tendon pathology
	• <b>Fractures and dislocations - articular &amp; peri-articular</b>	<b>CT</b>	<b>Without</b>	MRI may detect fractures occult on CT, especially in osteopenic patients.
	• <b>Hip - Suspected labral pathology</b>	<b>MRI</b>	<b>Without (intra-articular)</b>	MR arthrography
	• <b>Knee-staging of fx about the knee</b>	<b>MRI or CT</b>	<b>Without</b>	Consult musculoskeletal radiologist.
	• <b>Ligament pathology</b>	<b>MRI</b>	<b>Without</b>	
	• <b>Long bone fx - staging and eval. of</b>	<b>CT</b>	<b>Without</b>	
	• <b>Lymphoma &amp; multiple myeloma</b>	<b>MRI</b>	<b>Without &amp; With</b>	
	• <b>Meniscal pathology</b>	<b>MRI</b>	<b>Without</b>	MRI arthrography may be helpful for the postoperative meniscus
• <b>Nerve entrapment (suspected)</b>	<b>MRI</b>	<b>?</b>	Contrast is case specific. Consult musculoskeletal radiologist or leave to radiologist discretion.	

BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>MUSCULO-SKELETAL CONT'D</b>	• Occult joint effusion	MRI	Without	
	• Osteochondral defects/ osteoarthritis dissecans	MRI	Without	May give intra-articular contrast to assess stability of in situ fragment.
	• Scaphoid fracture - suspected radiographically occult	MRI	Without	Contrast exception: to evaluate for viability – order with contrast
	• Scaphoid fracture evaluation for suspected AVN/ viability.	MRI	Without & With	
	• Shoulder impingement syndrome/rotator cuff pathology.	MRI	Without	MR arthrography is even more sensitive and specific but not required.
	• Shoulder labral injury	MRI	Without (intra-articular?)	MR arthrography
	• Soft tissue masses	MRI (usually, see comment) CT less often	Without & With  With	CT is indicated to evaluate certain soft tissue masses such as myositis ossificans and other calcified masses. Consult musculoskeletal radiologist.
	• Soft tissue masses - peri-and-intraarticular	MRI	Without & With	CT or plain films may be complementary.
	• Sports hernia, pubalgia	MRI	Without	Sports hernia protocol
	• Synovial disease -primary	MRI	Without and With (Usually-See Comment	Consult musculoskeletal radiologist or leave to radiologist discretion.
	• Temporo-mandibular joint pathology	MRI	Without	
	• Tendon pathology	MRI	Without	
	• Thumb gamekeeper's fracture/UCL injury	MRI	Without	
	• Tumors (Primary) and metastatic disease	Plain film CT MRI	N/A With Without & With	Depending on specific situation, one modality may be preferred. Tests may also be complementary. Consult musculoskeletal radiologist or leave to radiologist discretion.
	• Wrist - suspected tfc, scapholunate ligament, or lunotriquetral ligament injury	MRI	Without (intra-articular)	MR arthrography
Breast MRI is always ordered bilaterally unless for post-mastectomy or short-term followup for Unilateral abnormality				

BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>BREAST</b>	• <b>High risk screening/surveillance</b>	<b>MRI</b>	<b>Without &amp; With</b>	In patient with intermediate or high risk
	• <b>Pre-Operative Staging</b>	<b>MRI</b>	<b>Without &amp; With</b>	
	• <b>Bilateral implant evaluation</b>	<b>MRI</b>	<b>Without</b>	If history of cancer, order without & with contrast.
	• <b>Clinical breast problem not explained by mammography and/or ultrasound</b>	<b>MRI</b>	<b>Without &amp; With</b>	
<b>THORACIC (CHEST)</b>	CT is far superior at visualizing the lungs and organs in the chest cavity between the lungs. Unless directed by a radiologist, MRI is not recommended for initial evaluation of lung or mediastinal pathology. CT is the preferred modality for cancer, pneumonia and abnormal chest x-rays.			
	• <b>Aortic Aneurysm</b>	<b>MRA or CTA</b>	<b>With</b>	MRA preferred for young patients
	• <b>Interstitial lung disease</b>	<b>High Resolution CT</b>	<b>Without</b>	
	• <b>Mass, infiltrate</b>	<b>CT</b>	<b>With</b>	Contrast helpful for hilar disease.
	• <b>Nodule</b>	<b>CT</b>	<b>Without</b>	Peripheral nodules remote from hilum - no contrast. Follow up pulmonary nodules - no contrast.
	• <b>Pulmonary Embolus</b>	<b>CTA</b>	<b>With</b>	Image in hospital if acute or chest pain.
<b>HEART</b> To schedule call Bronson CT Dept.: (269) 341-8707	• <b>Coronary Artery evaluation</b>	<b>CTA</b>	<b>With</b>	
	• <b>Evaluation of:</b> <ul style="list-style-type: none"> <li>○ myocardial infarction</li> <li>○ cardiac viability</li> <li>○ cardiac function or morphology</li> </ul>	<b>Cardiac MRI</b>	<b>Without &amp; With</b>	
<b>ABDOMEN &amp;</b>	• <b>Abdominal pain-generalized</b>	<b>CT</b>	<b>With (Oral &amp; IV)</b>	For more specific concerns other than generalized screening, see individual organs.



BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>PELVIS</b>	• <b>Appendicitis</b>	<b>CT</b>	<b>With (Oral &amp; IV)</b>	
	• <b>Bowel Obstruction</b>		<b>With (Oral &amp; IV)</b>	
	• <b>Cancer patients</b>	<b>CT Abdomen &amp; Pelvis; may need Chest CT</b>	<b>With (Oral &amp; IV)</b>	Chest CT usually follows an Abd/pelvis CT for optimum IV contrast timing.
	• <b>Diverticulitis</b>		<b>With (Oral &amp; IV)</b>	
	• <b>Inflammatory Bowel Disease</b>	<b>CT Enterography</b>  <b>or</b> <b>MRI Enterography</b>	<b>With (Oral &amp; IV)</b>  <b>Without &amp; With</b>	
	• <b>Pancreatitis</b>	<b>CT</b>	<b>With (Oral &amp; IV)</b>	
<b>LIVER/ BILIARY</b>	• <b>Initial evaluation</b>	<b>CT</b>	<b>With</b>	
	• <b>Liver or biliary system lesion - known</b>	<b>MRI</b> <b>MRCP</b>	<b>Without &amp; With</b> <b>Without</b>	It MRI contraindicated, order a CT with contrast, Liver protocol.
	• <b>Cavernous Hemangioma</b>	<b>CT</b> <b>MRI</b>	<b>With</b> <b>Without &amp; With</b>	<b>CT</b> -Initial evaluation <b>MRI</b> -Confirmation
	• <b>Metastatic disease-initial eval.</b>	<b>CT</b>	<b>With</b>	
<b>PANCREAS</b>	• <b>Initial evaluation</b>	<b>CT</b>	<b>With (Oral &amp; IV)</b>	Pancreatic protocol CT Abdomen. MRI of the pancreas may be recommended by the radiologist as indicated for further evaluation
<b>SPLEEN</b>	• <b>General Screening</b>	<b>CT</b>	<b>With</b>	
	• <b>Splenic Lesion – Known</b>	<b>MRI</b>	<b>Without &amp; With</b>	
	• <b>Hematuria - painless</b>	<b>CT Abdomen &amp; Pelvis</b>	<b>With (No Oral)</b>	

BODY PART	CLINICAL PROBLEM	PREFERRED STUDY	CONTRAST	COMMENTS
<b>KIDNEYS, URETERS &amp; BLADDER</b>	• Hematuria – Painful, r/o kidney stone	CT Abdomen-Stone Protocol	Without	If negative, may need F/U CT Abdomen and Pelvis with IV Contrast.
	• Renal Mass	CT Abdomen & Pelvis	With (No Oral)	Useful for indeterminate renal cysts/lesions on ultrasound Consider MRI without & with contrast if indeterminate
	• Urothelial malignancy	CT Urogram  MRI	With  Without & With	Screening for patient with hematuria and for more complete evaluation of the renal collecting systems, ureters and bladder.  If there is a known lesion for which follow up or further evaluation is needed, an MRI with contrast may be indicated.
<b>ADRENAL GLANDS</b>	• Initial evaluation	CT	With	Order Adrenal protocol. If inconclusive, radiologist will recommend follow up with an MRI with contrast, which should be definitive.
<b>UTERUS/ OVARIES</b>	• Evaluation of uterus and ovaries	MRI	Without & With	MRI used in problem solving ultrasound cases
	• Uterine Fibroids	MRI	Without & With	For determining the size, presence and location of uterine fibroids (after US).
<b>AORTA/ VASCULAR</b>	• Aortic Aneurysm, dissection or follow up of aortic endograft placement	MRA or CTA	With	MRA preferred for young patients
	• Aortic Dissection	MRA or CTA	With	
	• Aortic Endograft Placement	CTA	Without & With	
	• Vascular Imaging	MRA or CTA	Without & With With	For upper and lower extremity vascular imaging
	• Evaluation of mesenteric or renal arteries	MRA or CTA	Without & With CTA: With	In special cases MRI can be done without contrast (renal failure).



