



Magnetic Resonance Imaging (MRI) Prioritization

Effective Date: September 16, 2020

Scope

This guideline summarizes suggested wait times for common indications where Magnetic Resonance Imaging (MRI) is the recommended first imaging test. The purpose is to inform primary care practitioners of how referrals are prioritized by Radiologists and Radiology departments across the province. This guideline is an adaptation of the British Columbia Radiological Society (BCRS) MRI Prioritization Guidelines (2013).¹ Management of the listed clinical problems is beyond the scope of this guideline. However, in some cases, notes and alternative tests are provided for additional clinical context. Primary care practitioners are encouraged to consult a Radiologist if they have any concerns or questions regarding which appropriate imaging test to choose for a problem. If in doubt consult with a Radiologist and review provincial guidance materials.²

Background

The 2013 BCRS MRI Prioritization Guidelines were developed to provide imaging departments with a consistent, provincial approach to prioritizing commonly ordered MRI tests according to suggested maximum wait times. The BCRS guidelines were developed by consensus and are based on BC expert opinion with representation of Radiologists from across the province. Several considerations apply:

- These are guidelines, and as such, are designed to apply in general terms. They are not intended to replace clinical judgement or practitioner-to-practitioner discussion.
- Prioritization levels were selected to match other similar guidelines for Computed Tomography (CT) and Ultrasound (US) and are typically assigned by Radiologists rather than referring practitioners.
- These guidelines should not be applied rigidly to each case, as varying clinical factors may shift an indication from one priority level to another.
- Access to MRI and the ability to respond to MRI requests will depend on resourcing or local availability.
- Providing detailed patient information is essential to aid with the prioritization process.
- The clinical topics included in this guideline represent broad examples, and do not encompass all possible scenarios or all requirements for MRI examinations.

Priority Level Definitions

The priority levels defined below (Table 1) are in alignment with the Canadian Association of Radiologists national designation Five Point Classification System.³

Table 1: Priority Level Definitions

Priority Level	Clinical Example	Maximum Suggested Wait Time
P1	An examination immediately necessary to diagnose and/or treat life-threatening disease. Such an examination will need to be done either stat or not later than the day of the request.	Immediately to 24 hours
P2	An examination indicated within one week of a request to resolve a clinical management imperative.	Maximum 7 calendar days
P3	An examination indicated to investigate symptoms of potential importance.	Maximum 30 calendar days
P4	An examination indicated for long-range management or for prevention.	Maximum 60 calendar days
P5	Timed follow-up exam or specified procedure date recommended by Radiologist and/or clinician.	

Source: Adapted from the *Canadian Association of Radiologists National Maximum Wait Time Access Targets for Medical Imaging*.

Prioritization of Potential Diagnoses

MRI is indicated for multiple conditions, including but not exclusively, for the following⁴ (see separate sections for specific clinical indications):

- Assessment of neurological disorders, including brain and spinal contents
- Functional imaging of the brain
- Assessment of musculoskeletal disorders
- Staging of malignancies; head and neck, prostate, gynecological and pelvic
- Assessment of cardiac, aortic and vascular disorders
- Assessment of abdominal conditions (e.g. liver, biliary tree, pancreas, kidneys, anal fistula)
- Breast imaging
- MR-guided interventional procedures

The following potential diagnoses, where MRI is the recommended first test, are grouped according to system and then further subdivided into priority levels. For each system an overview table is presented followed by a more detailed table outlining additional notes and alternative tests where appropriate.

Referring practitioners should include clear, pertinent clinical history on radiology requisitions to assist the triaging/prioritizing of examinations and interpretation of images and may consider noting the priority directly on the requisition where possible.

► Head and Neck

Head and Neck: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
<ul style="list-style-type: none"> Acute visual loss Pre-operative Central Nervous System (CNS) neoplasm or vascular malformation evaluation Acute hydrocephalus Central nervous system (CNS) infection Central nervous system (CNS) venous thrombosis Acute stroke High grade Internal Carotid Artery (ICA) stenosis and/or carotid dissection 	<ul style="list-style-type: none"> Staging of malignancy Symptomatic orbital mass Staging of CNS neoplasm (primary or metastatic) Encephalitis-like symptoms (non-infection) Acute Multiple Sclerosis flare, being considered for therapy 	<ul style="list-style-type: none"> Orbital mass with no clinical deficits Characterization of neck masses Sellar lesions – no clinical deficits (e.g. pituitary microadenoma) Multiple Sclerosis 	<ul style="list-style-type: none"> Mild cognitive impairment / Dementia work-up Neurodegenerative disorders Non-surgical / chronic seizure disorders, no Electroencephalography (EEG) focus Cerebral aneurysm screening (familial, polycystic kidneys) Sensorineural hearing loss Trigeminal neuralgia persistent/refractory 	<ul style="list-style-type: none"> Postoperative follow-up

Head and Neck: Notes and Alternative Tests		
	Potential Diagnosis	Notes and Alternative Tests
P1	Acute visual loss	<ul style="list-style-type: none"> For example, optic nerve compression
	Pre-operative CNS neoplasm or vascular malformation evaluation	<ul style="list-style-type: none"> As requested by specialist (Neurosurgeon)
	Acute stroke	<ul style="list-style-type: none"> Preferred test is CT/CTA +/- perfusion imaging
	High grade ICA stenosis and/or dissection	<ul style="list-style-type: none"> Preferred test is CTA
P2	Staging of CNS neoplasm (primary or metastatic)	Primary: <ul style="list-style-type: none"> Characterization and staging of a known primary CNS neoplasm
		Metastatic: <ul style="list-style-type: none"> Clinically suspected metastatic brain disease in a patient with a known primary
P3	Sensorineural Hearing Loss	<ul style="list-style-type: none"> Sensorineural hearing loss (may be secondary to vestibular schwannoma) – assessed with MRI Conductive hearing loss - assessed with temporal bone CT
P4	Trigeminal neuralgia persistent/refractory	<ul style="list-style-type: none"> Does not routinely require imaging

► Spine

Spine: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
<ul style="list-style-type: none"> Acute spine injury / cord compression / acute cord syndrome Acute septic processes such as septic discitis 	<ul style="list-style-type: none"> Acute myelopathy Radiculopathy 	<ul style="list-style-type: none"> Acute spinal symptoms with red flags (not otherwise in P1 or P2) 	<ul style="list-style-type: none"> Chronic spine symptoms 	<ul style="list-style-type: none"> Postoperative follow-up

Spine: Notes and Alternative Tests		
	Potential Diagnosis	Notes and Alternative Tests
P3	Acute spinal symptoms with red flags (not otherwise in P1 or P2)	<ul style="list-style-type: none"> See red flags table below.
P4	Chronic spine symptoms	<ul style="list-style-type: none"> Chronic spine symptoms, including chronic pain, stable radiculopathy, stable deformity After a trial of conservative treatment. If persistent and of a severity for which surgery is being considered See Choosing Wisely in the resources section or refer to Appropriate Imaging for Common Situations in Primary and Emergency Care⁴

Appropriate Imaging for Common Situations in Primary and Emergency Care⁵

Back Pain
Imaging is not recommended unless red flags are present
<p>Consider imaging in the following red flag situations:</p> <ul style="list-style-type: none"> Severe or progressive neurological deficit (e.g. cauda equina, saddle anesthesia) Significant acute traumatic event immediately preceding onset of symptoms Suspected compression fracture or pathological fracture (risk factors include long term steroid use) Suspected cancer, cancer related complication, or history of cancer (e.g. night sweats or night pain) Suspected infection (e.g. discitis/osteomyelitis, epidural abscess), risk factors include history of IV drug use, history of fever or chills Suspected spinal epidural hematoma Older age with first episode of back pain Low back pain lasting greater than six months

Note: Back pain may be due to conditions other than spinal and may warrant imaging of the abdomen or pelvis.

► Musculoskeletal/Extremity

Musculoskeletal/Extremity: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
<ul style="list-style-type: none"> Muscle necrosis / compartment syndrome Acute septic processes such as septic arthritis 	<ul style="list-style-type: none"> Staging of malignancy Occult fractures Acute osteomyelitis Locked knee 	<ul style="list-style-type: none"> Brachial plexopathy (non-surgical, e.g. tumor infiltration) Acute/traumatic joint dysfunction. Intermittent or recurring locking with instability Bone and soft tissue neoplasm characterization 	<ul style="list-style-type: none"> Chronic joint pain or instability syndromes with red flags TMJ derangement 	<ul style="list-style-type: none"> Postoperative follow-up

Musculoskeletal/Extremity: Notes and Alternative Tests		
	Potential Diagnosis	Notes and Alternative Tests
P2	Staging of malignancy	<ul style="list-style-type: none"> Bone scan is complementary for assessing metastases MRI for evaluating primary bone and soft tissue masses
	Occult fractures	<ul style="list-style-type: none"> CT is the best first test. Bone scan may be used for stress fracture evaluation
	Acute osteomyelitis	<ul style="list-style-type: none"> Plain radiographs or bone scan are usually the best first tests. MRI is usually if evaluation remains inconclusive
P3	Brachial plexopathy (non-surgical, e.g. tumor infiltration)	<ul style="list-style-type: none"> Usually ordered by specialists after evaluation
	Acute/traumatic joint dysfunction	<ul style="list-style-type: none"> MRI for preoperative evaluation; including Anterior Cruciate Ligament (ACL), Posterior Cruciate Ligament (PCL), meniscus, rotator cuff tears and Avascular Necrosis (AVN). Acute shoulder dysfunction and rotator cuff tears (may also be imaged with US, if available)
	Bone and soft tissue neoplasm characterization (lipoma)	<ul style="list-style-type: none"> US can be used initially to determine if mass is solid or cystic A painful or growing mass warrants further evaluation with MRI
P4	Chronic joint pain or instability syndromes with red flags	<ul style="list-style-type: none"> Plain radiography is the best first test MRI is rarely indicated for degenerative osteoarthritis and is almost never a first line test before radiography MR Arthrography is usually ordered by specialists See red flags table below

Appropriate Imaging for Common Situations in Primary and Emergency Care⁵

MRI Knee and Hip Appropriateness Criteria

Imaging is not recommended unless red flags are present

Consider imaging in the following red flag situations:

- Consider discussion with an orthopedic surgeon for:
 - Previous knee or hip surgery, may be urgent
 - Suspected infection, may be urgent
 - Suspected tumor
 - Fixed locked knee, may be urgent
- MRI was recommended on a previous imaging report (attach report to requisition)
- Osteonecrosis
- Patient had a weight-bearing x-ray within the past 6 months **and** referring clinician has confirmed mild or no evidence of osteoarthritis in the knee or hip.

► Breast

Breast: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
	<ul style="list-style-type: none"> Breast cancer assessment 		<ul style="list-style-type: none"> Breast implant evaluation 	<ul style="list-style-type: none"> Breast MRI screening for high-risk populations

Breast: Notes and Alternative Tests

	Potential Diagnosis	Notes and Alternative Tests
P2	Breast Cancer assessment	<ul style="list-style-type: none"> Usually done pre-operatively with a preferred date when indicated by radiology or surgery
P4	Breast Implant Evaluation	<ul style="list-style-type: none"> MRI is used typically when looking for an implant rupture
P5	Breast MRI screening for high risk patients	<ul style="list-style-type: none"> Please refer to the BC Cancer Agency breast screening program listed in the resources section for guidance

► Cardiac

Cardiac: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
	<ul style="list-style-type: none"> Cardiac viability Assessment of cardiac mass / thrombus Inflammatory / infectious myo-/pericarditis Adult congenital heart disease (acute deterioration) Scar quantification prior to ICD 	<ul style="list-style-type: none"> Cardiomyopathies (ischemic and non-ischemic) Cardiac function (including valve) Constrictive pericarditis Infiltrative /inflammatory disease (e.g. amyloid/ sarcoid) 	<ul style="list-style-type: none"> Scar quantification (stable) Stable aortic dissection Iron overload Fabry's disease 	<ul style="list-style-type: none"> Postoperative follow-up Follow-up of known chronic conditions

Cardiac: Notes and Alternative Tests		
	Potential Diagnosis	Notes and Alternative Tests
P2	Cardiac viability	<ul style="list-style-type: none"> Following specialist referral. Normally used for functional assessment if not well seen with Echocardiography
	Assessment of cardiac mass / thrombus	<ul style="list-style-type: none"> Following specialist referral
	Adult congenital heart disease (acute deterioration)	<ul style="list-style-type: none"> Complication, deterioration, change in cardiac status
P4	Scar quantification (stable)	<ul style="list-style-type: none"> Ischemia, Hypertrophic cardiomyopathy (HCM), Dilated cardiomyopathy (DCM)
	Stable aortic dissection	<ul style="list-style-type: none"> When CT radiation dose is a consideration (younger patients, Marfan Syndrome)

► Abdomen and Pelvis

Abdomen and Pelvis: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
<ul style="list-style-type: none"> Acute abdomen in pregnancy (e.g. appendicitis, renal colic) Pelvic imaging for young women <35 years old (e.g. ovarian torsion, appendicitis) Acute pancreaticobiliary pathology 	<ul style="list-style-type: none"> Staging of malignancy Fetal and placental anomalies 	<ul style="list-style-type: none"> Evaluate specific conditions of the liver, gallbladder, bile ducts and pancreas Characterize masses of spleen, kidneys and adrenals Pre-liver transplant assessment of hepatic vasculature and biliary anatomy Inflammatory bowel disease Suspicious ovarian masses or cyst Prostate cancer evaluation 	<ul style="list-style-type: none"> Uterine fibroids, adenomyosis, endometriosis Perianal fistula Congenital anomaly of the male and female pelvic organs 	<ul style="list-style-type: none"> Prostate cancer active surveillance Postoperative/post-treatment follow-up

Abdomen and Pelvis: Notes and Alternative Tests

	Potential Diagnosis	Notes and Alternative Tests
P1	Acute abdomen in pregnancy (e.g. appendicitis, renal colic)	<ul style="list-style-type: none"> CT is usually the best first test for acute abdomen, except for pregnant patients where MRI is preferred to reduce fetal radiation exposure
	Pelvic imaging for young women <35 years old (e.g. ovarian torsion, appendicitis)	<ul style="list-style-type: none"> US is usually the best first test. MRI should be considered for young women to reduce radiation exposure if US equivocal
	Acute pancreaticobiliary pathology	<ul style="list-style-type: none"> Consider if US and/or CT inconclusive. MRCP to assess for choledocholithiasis
P2	Staging of malignancy	<ul style="list-style-type: none"> CT is usually the best test for overall staging. MRI is adjunct test for specific indications including staging of pancreatic hepatobiliary, rectal, and gynecological masses
	Fetal and placental anomalies	<ul style="list-style-type: none"> Used in addition to US examination Ordered under direction of specialist
P3	Evaluate the liver, gallbladder, bile ducts, and pancreas	<ul style="list-style-type: none"> CT and US are usually the best first test. MRI if CT or US are indeterminate for evaluation of solid organ masses or biliary dilatation. Commonly combined with Magnetic Resonance Cholangiopancreatography (MRCP)
	Characterize masses of spleen kidneys and adrenals	<ul style="list-style-type: none"> To further characterize and stage
	Pre-liver transplant assessment of hepatic vasculature and biliary anatomy	<ul style="list-style-type: none"> For potential hepatic donor evaluation Normally ordered by transplant team Can also be used for post-transplant assessment
	Inflammatory bowel disease	<ul style="list-style-type: none"> MRI is particularly useful in younger patients (<40) to minimize radiation exposure from multiple CTs (GI specialist typically ordering)
	Suspicious ovarian masses or cysts	<ul style="list-style-type: none"> US is usually the first test performed. MRI used for further characterization if recommended by a Radiologist or by OB/GYN
	Prostate cancer evaluation	<ul style="list-style-type: none"> Normally ordered by Urology. Can be used to guide biopsy
P4	Uterine fibroid, adenomyosis, endometriosis	<ul style="list-style-type: none"> MRI also valuable pre uterine fibroid embolization and for surgical planning
P5	Prostate cancer active surveillance	<ul style="list-style-type: none"> Usually ordered by Urology

► Pediatric

Pediatric: Overview				
P1	P2	P3	P4	P5
Immediately to 24 hours	Max 7 calendar days	Max 30 calendar days	Max 60 calendar days	
<ul style="list-style-type: none"> Traumatic spinal cord injury Cord compression Stroke Appendicitis (see notes) Septic joint 	<ul style="list-style-type: none"> Non-accidental trauma Acute disseminated Encephalomyelitis (ADEM) and other acute encephalopathy Staging of malignancy; abdominal/pelvic mass, head and neck mass, aggressive bone lesion Congenital Heart Disease (see notes) Acute osteomyelitis Hypoxic ischemic encephalopathy 	<ul style="list-style-type: none"> Inflammatory Bowel Disease Inflammatory Arthropathy Headache with red flags 	<ul style="list-style-type: none"> Seizure disorder Scoliosis evaluation Congenital anomaly assessment Periventricular leukomalacia Developmental delay Vascular malformation 	<ul style="list-style-type: none"> Postoperative follow-up

Pediatric: Notes and Alternative Tests

	Potential Diagnosis	Notes and Alternative Tests
P1	Stroke	<ul style="list-style-type: none"> CT/CTA should also be considered
	Appendicitis	<ul style="list-style-type: none"> MRI rarely indicated. US is first line imaging test after clinical triage MRI only if US is equivocal and moderate to high clinical suspicion of appendicitis
P2	Staging of malignancy; abdominal/pelvic mass, head and neck mass, aggressive bone lesion	<ul style="list-style-type: none"> CT, PET-CT or MIBG SPECT-CT may be preferred depending on suspected tumor type. Referral to pediatric subspecialist prior to staging of suspected malignancy is recommended
	Congenital Heart Disease	<ul style="list-style-type: none"> P2-P4 depending on indication. Referral to Pediatric cardiology prior to imaging - echocardiography may be preferred imaging modality. Imaging is performed at BC Children's Hospital
	Acute osteomyelitis	<ul style="list-style-type: none"> Becomes P1 if septic joint is suspected in conjunction with osteomyelitis
	Hypoxic ischemic encephalopathy	<ul style="list-style-type: none"> Initial scan at 72 hours post event and subacute scan at 10 days post event. If there is a remote history of HIE then P4 (ideally to be done at age of 2-3 years) Normally ordered by Pediatrician
P3	Headache with red flags	<ul style="list-style-type: none"> See red flags table below
P4	Seizure disorder	<ul style="list-style-type: none"> Usually no investigation required for first seizure in child. EEG and neurology referral are priority for child with >1 afebrile seizure Many childhood seizure types (25%) are genetic and do not require imaging If imaging is indicated, then usually P4 unless clinical neurology or severity indicate otherwise
	Periventricular leukomalacia	<ul style="list-style-type: none"> Ideally done at age 2-3 years
	Developmental delay	<ul style="list-style-type: none"> Ideally done at age 2-3 years if diagnosed before age 2
	Vascular malformation	<ul style="list-style-type: none"> P2 if causing airway compromise

Appropriate Imaging for Common Situations in Primary and Emergency Care⁵

Uncomplicated Headaches

Imaging is not recommended unless **red flags** are present

Consider imaging in the following **red flag** situations:

- Sudden onset of severe headache (thunderclap)
- Recurrent headache with unexplained focal neurological signs or other symptoms with focal deficits
- New onset in the setting of HIV or cancer
- Abnormal neurological exam
- Suspected intracranial infection
- New onset or worsening seizure
- Headache causing awakening from sleep
- Papilledema
- Worsening headache frequency or severity in a patient with previous headache history or recent head trauma
- Acute head trauma if indicated by CT head clinical decision rule

Resources

- American College of Radiology Appropriateness Criteria
<https://www.acr.org/Quality-Safety/Appropriateness-Criteria>
- BC Cancer Agency, Breast Screening Program
<http://www.bccancer.bc.ca/screening/breast>
- BC Cancer, Family Practice Oncology Network Guidelines and Protocols
<http://www.bccancer.bc.ca/health-professionals/networks/family-practice-oncology-network/guidelines-protocols>
- BC Guidelines *Appropriate Imaging for Common Situations in Primary and Emergency Care*
<https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/bc-guidelines/appropriate-imaging>
- Canadian Association of Radiology *Diagnostic Imaging Referral Guidelines* (2012)
<http://www.car.ca/en/standards-guidelines/guidelines.aspx>
- CAR Standard for Magnetic Resonance Imaging (2011)
<https://car.ca/wp-content/uploads/Magnetic-Resonance-Imaging-2011.pdf>
- Canadian Association of Radiologists *Radiology Resumption of Clinical Services* (2020)
https://car.ca/wp-content/uploads/2020/05/CAR-Radiology-Resumption-of-Clinical-Services-Report_FINAL-2.pdf
- Choosing Wisely Radiology Recommendations - Radiology:
<http://www.choosingwiselycanada.org/wp-content/uploads/2014/04/Radiology.pdf>
- Essential Imaging, BC Patient Safety and Quality Council
<https://bcpsqc.ca/improve-care/medical-imaging/>
- Image Wisely
<https://www.imagewisely.org/>
- Medical Imaging Advisory Committee. *Provincial Guidance for Medical Imaging Services within British Columbia During the Pandemic Phases* (June 2020).
http://www.bccdc.ca/Health-Professionals-Site/Documents/COVID19_MedicalImagingGuidePractitioners.pdf
- RACE line – Rapid Access to Consultative Services, includes Radiology consultation services:
<http://www.raceconnect.ca/>
- Radiology Info for Patients
<https://www.radiologyinfo.org/>
- The Fleischner Society Publications
<https://fleischner.memberclicks.net/white-papers>

► References

1. BC Radiological Society. *MRI Prioritization Guideline* (2013)
2. Medical Imaging Advisory Committee. *Provincial Guidance for Medical Imaging Services within British Columbia During the Pandemic Phases* (June 2020).
http://www.bccdc.ca/Health-Professionals-Site/Documents/COVID19_MedicalImagingGuidePractitioners.pdf
3. Canadian Association of Radiologists *National Maximum Wait Time Access Targets for Medical Imaging (MRI and CT)*.
<https://car.ca/wp-content/uploads/car-national-maximum-waittime-targets-mri-and-ct.pdf>
4. International Radiology Quality Network. *Referral Guidelines for Diagnostic Imaging: A Supporting Tool for Healthcare Professionals in the Selection of Appropriate Procedures*. 2017. <http://www.isradiology.org/quality-guidelines>
5. BC Guidelines. *Appropriate Imaging for Common Situations in Primary and Emergency Care*
<https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/bc-guidelines/appropriate-imaging>

This guideline is based on expert BC clinical practice current as of the effective date. This guideline was developed by the Guidelines and Protocols Advisory Committee based on the British Columbia Radiological Society MRI Prioritization Guidelines (2013), and approved by the Medical Services Commission.

THE GUIDELINES AND PROTOCOLS ADVISORY COMMITTEE

The principles of the Guidelines and Protocols Advisory Committee are to:

- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances

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