



Appropriate Imaging for Common Situations in Primary and Emergency Care

Effective Date: December 11, 2019

Scope

This guideline provides recommendations to primary and emergency care providers on how to assess the need for diagnostic imaging in five common situations: low-back pain (adults), minor head injuries (all ages), uncomplicated headache (adults), hip and knee pain (adults), and suspected pulmonary embolism (non-pregnant adults). Management of these conditions is beyond the scope of this guideline. However, in some cases, notes and alternatives to imaging are provided for additional clinical context.

Key Recommendations

- Imaging is not recommended for uncomplicated headache unless red flags are present ([page 2](#)).
- CT head scans are not recommended in adults and children who have suffered minor head injuries unless positive for a head injury clinical decision rule ([page 3](#)).
- Chest CT for suspected pulmonary embolism is not recommended in low-risk patients with a normal D-dimer result ([page 5](#)).
- Imaging is not recommended for low back pain unless red flags are present ([page 7](#)).
- MRIs of hip or knee joints are not recommended in patients with co-existent pain and moderate to severe osteoarthritis unless red flags are present ([page 8](#)).
- Practitioners are encouraged to consult a radiologist if they have any concerns or questions regarding which imaging test is appropriate for a given problem.

Background

The purpose of this guideline is to communicate best practice for imaging in common situations in primary and emergency care, in order to promote appropriate use of imaging resources in BC. Access to diagnostic imaging services, and the ability to respond to emergency/urgent imaging requests, will depend on local availability. When in doubt, direct consultation with a radiologist is encouraged.

Appropriate Use of CT for Uncomplicated Headache in Adults

Objective: to guide decision-making regarding the use of head CT in adults with uncomplicated headache.

Rationale: CT of the head exposes the patient to radiation. The need for imaging with CT must be balanced against the risk of radiation. When in doubt, consult with the relevant specialist locally or through the RACE Line.

Recommendation: Imaging is not recommended for uncomplicated headache unless red flags are present.

► **Consider imaging in the following “red flag” situations:**¹

- sudden onset of severe headache (thunderclap)
- recurrent headache with unexplained focal neurological signs² 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
- new headache age > 50
- 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 (page 5)

► **Think twice before requesting head CT for:**

- migraine
- syncope
- temporal arteritis
- multiple sclerosis
- sinusitis
- chronic post-concussion syndrome with normal neurological exam

Key messages for counselling patients if imaging is not indicated:

- Most headaches are benign and self-limiting and do not require a CT head scan or MRI for diagnosis.

Patient and Caregiver Resources

- [Imaging Tests for Headaches: When you need them and when you don't](#) – Choosing Wisely Canada

Appropriate Use of CT for Minor Head Injury in Adults and Children

Objective: to guide decision making regarding the use of head CT in adults and children with minor head injury.

Rationale: CT of the head exposes the patient to radiation. Practitioners should consider the risk of CT radiation exposure. Radiation risks are highest in infants and decrease with age. The following clinical decision rules balance the benefit of identifying a treatable brain injury with the risks associated with radiation exposure. When in doubt, consult with the relevant specialist locally or through the RACE Line.

Recommendation: Do not request CT head scans in patients who have suffered minor head injuries unless positive for a validated head injury clinical decision rule such as:

- Adults age 16+: Canadian CT Head Rule (below)
- Children: PECARN Rule ([page 4](#))

In situations where CT is not readily available, consultation with a specialist is encouraged to help guide medevac decisions.

► Canadian CT Head Rule (for adults and adolescents age 16+)³

The Canadian CT Head Rule can be applied to patients with a “minor” head injury.

In this context, “minor” means a head injury with Glasgow Coma Scale (GCS) 13-15 AND with one of:

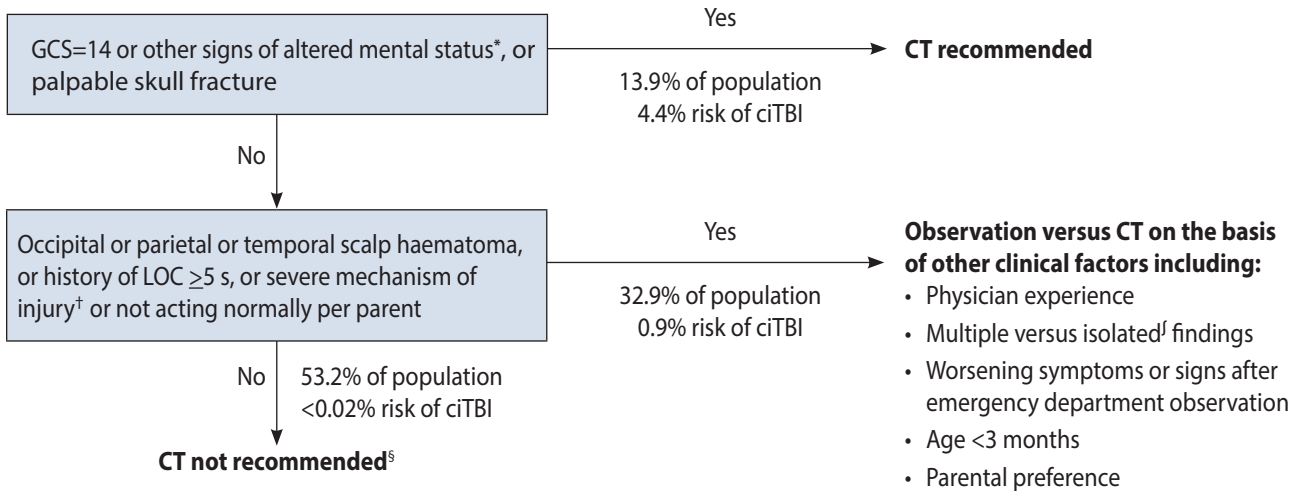
- a witnessed loss of consciousness (LOC), or
- amnesia to the head injury event, or
- witnessed disorientation.

A CT head is recommended for patients who fulfil the inclusion criteria above AND any ONE of the following findings:

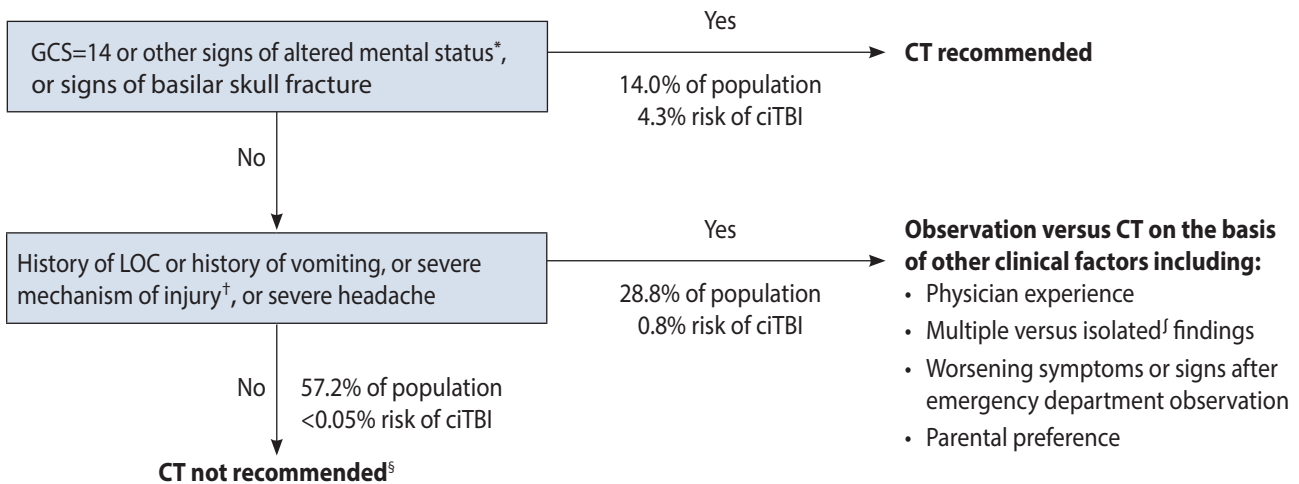
- **High risk (for neurological intervention)**
 - o GCS score <15 at 2h after injury
 - o Suspected open or depressed skull fracture
 - o Any sign of basal skull fracture (haemotympanum, ‘raccoon’ eyes, cerebrospinal fluid otorrhoea/rhinorrhoea, Battle’s sign)
 - o Vomiting ≥2 episodes
 - o Age ≥65 years
- **Medium risk (for brain injury on CT)**
 - o Amnesia > 30 minutes preceding impact
 - o Dangerous mechanism of injury (e.g., pedestrian struck by motor vehicle, occupant ejected from motor vehicle, fall from height >3 feet or five stairs)

Patients who are on blood thinners or have a post-traumatic seizure are excluded from the Canadian CT Head Rule and require individualized assessment.

► **PECARN rule for infants and toddlers younger than 2 years with GCS scores of 14-15 after head trauma⁴**



► **PECARN rule for children and toddlers aged 2 years and older with GCS scores of 14-15 after head trauma⁴**



Patient and Family Resources:

- [BC Children's Hospital – Head Injury Advice for Parents and Caregivers](#)
- [Concussion Awareness Training Tool](#) (for medical professionals, coaches, parents, caregivers, athletes)

* Other signs of altered mental status: agitation, somnolence, repetitive questioning, or slow response to verbal communication

† Severe mechanism of injury: motor vehicle crash with patient ejection, death of another passenger, or rollover; pedestrian or bicyclist without helmet struck by a motorised vehicle; falls of more than 3 feet for children <age 2 or 5 feet for children age 2+, or head struck by a high-impact object

^J Patients with certain isolated findings (i.e., with no other findings suggestive of traumatic brain injury), such as isolated LOC, isolated headache, isolated vomiting, and certain types of isolated scalp haematomas in infants older than 3 months, have a risk of clinically-important traumatic brain injury substantially lower than 1%.

[§] Risk of clinically-important traumatic brain injury is exceedingly low, generally lower than risk of CT-induced malignancies. Therefore, CT scans are not indicated for most patients in this group.

Appropriate Use of CT for Suspected Pulmonary Embolism in the Non-Pregnant Adult

Objective: To guide decision making regarding the use of CT in a stable, non-pregnant adult patient presenting with a suspected pulmonary embolism (PE), based on history and physical exam.

Rationale: CT of the chest exposes the patient to radiation. The need for imaging with CT must be balanced against the risk of radiation. When in doubt, consult with the relevant specialist locally or through the RACE Line.

Key points:

- Patients at high risk of PE should be referred to the emergency department and not managed initially in the community.
- Practitioners are reminded to consider risk factors that might alter the pre-test probability. This strategy applies to the majority of people and does not account for unique risk factors (e.g., anabolic steroids, athletes, elderly, paraplegics, etc.). If patients have persistent symptoms beyond 24–48 hours, they should go to the emergency department for further assessment.
- Use a clinical decision rule such as the Wells Score (Table 1) to determine whether the patient is low-risk or high-risk.
- For low risk adult patients:
 - If PERC score (Table 2) is 0, then PE is ruled out. There is no need for further investigation.
 - If PERC score (Table 2) is >0, a D-dimer should be ordered. If D-dimer is positive, further imaging should be ordered.
 - Do not request imaging (CT pulmonary angiogram [CTPA] or ventilation-perfusion [VQ] lung scan) for pulmonary embolism in those with a normal D-dimer result (see below).
- For high risk adult patients: Start empiric treatment with anticoagulant therapy if confirmatory imaging (CTPA, VQ lung scan) is not immediately available.

Recommendation: When a stable, non-pregnant adult patient presents with signs and symptoms suspicious for PE, the following sequential steps should be done to determine whether a CTPA is required:⁵

1. Assess pre-test probability using a clinical decision rule (e.g., Wells Score).^{14,15}

- If the total Wells score is ≥ 4.5 (PE likely), proceed to imaging.
- If < 4.5 (PE unlikely), proceed to the pulmonary embolism rule-out criteria (PERC Rule).

Table 1. Wells Score

Variable	Points
Clinical signs and symptoms of DVT	3
No alternative diagnosis more likely than PE	1.5
Heart rate >100 bpm	1.5
Immobilization ≥ 3 days or surgery in the past 4 weeks	1.5
Previous PE or DVT	1
Hemoptysis	1
Malignancy	3

2. PERC Rule

- If the patient is low-risk (PE unlikely) and the PERC score is 0 (all of the items are true), the likelihood of PE is <2% and CTPA is not recommended.
- If the patient is low-risk and the PERC score is >0 (one or more items is not true), proceed to D-dimer.

Table 2. PERC Rule

Criteria	Meets criteria	Does NOT meet criteria
Age < 50	0	1
Initial heart rate <100 bpm	0	1
Initial SaO ₂ > 94% on room air	0	1
No unilateral leg swelling	0	1
No hemoptysis	0	1
No surgery or trauma ≤ 4 weeks	0	1
No history of VTE	0	1
No estrogen use	0	1

3. D-dimer: CTPA is not recommended if D-dimer is below the normal range for your institution.

Clinicians may use a negative age-adjusted D-dimer result using a high-sensitivity assay to exclude the diagnosis of PE in patients older than 50 years who have a low risk for acute PE according to a validated risk score (e.g., Wells score or simplified, revised Geneva score).

For more detailed guidance on diagnosis of PE, refer to the BC Emergency Medicine Network Point-of-Care Emergency Clinical Summary, available from: bcemergencynetwork.ca/clinical_resource/pulmonary-embolism-diagnosis/

Diagnostic imaging for suspected PE in pregnant patients

- Specialist consultation is recommended (radiology, obstetrics)
- It is unclear whether CTPA or ventilation-perfusion (V/Q) scanning is preferable in pregnant patients^{5,6}
- Radiation dose from CTPA and V/Q scanning may be dependent on the scanners available at a given site

Appropriate Imaging for Acute Low Back Pain in Adults

Objective: to guide decision making regarding whether imaging is needed in an adult patient presenting to primary care or the emergency department with acute low back pain (defined as low back pain of less than 6 weeks duration).

Rationale: X-ray and CT expose the patient to radiation. The need for imaging must be balanced against the risk of radiation. When in doubt, consult with the relevant specialist locally or through the RACE Line. Imaging of low back pain without red flags is unlikely to change management or improve treatment.⁶⁻¹⁰ Acute (new onset) low back pain usually resolves by 6 weeks.^{9,11}

Recommendation: Diagnostic imaging (x-ray, CT or MRI) for low back pain of less than 6 weeks duration is not recommended unless one of the following red flags is present:^{1, 12}

- severe or progressive neurologic deficit, e.g., cauda equina
- significant acute traumatic event immediately preceding onset of symptoms
- suspected compression fracture (risk factors include long term steroid use)
- suspected cancer, cancer related complication, or history of cancer
- suspected infection (e.g., discitis/osteomyelitis, epidural abscess; risk factors include history of IV drug use)
- suspected spinal epidural hematoma
- older age with first episode of severe back pain

Key messages for counselling patients if imaging is not indicated:

- Acute (new onset) low back pain usually resolves within 6 weeks
 - o CT, MRI and x-rays for uncomplicated low back pain do not help patients get better faster and may expose them to unnecessary risks and incidental findings. There is often poor correlation between imaging findings and symptoms.
 - o Low back pain is very common and often caused by back strain. It usually resolves within weeks without medical treatment. Check back with your health care provider if the pain is getting worse not better, or if you have new symptoms.
 - o Treat low back pain with heat, acetaminophen, NSAIDs, and gradual return to usual activities.
- Exercise may decrease low back pain symptoms⁸ and may reduce recurrence⁹
- Address fear of activity and return to work and normal activities¹⁰
- Recommend physiotherapy if exercise persistently makes the pain worse⁹

Practitioner resources

- BC Emergency Medicine Network: [Clinical Resource – Low Back Pain](#)

Patient and caregiver resources

- Patients can call 8-1-1 to speak with an exercise physiologist to receive individualized care including:
 - o exercises to address low back pain
 - o advice on how to increase physical activity
 - o support for motivation, education, identifying and overcoming barriers, and return to work
- Choosing Wisely Patient Handout - [Imaging Tests for Lower Back Pain: When you need them and when you don't](#) (available in French, Arabic, Punjabi, Simplified Chinese, Spanish, and Tagalog)
- [HealthLinkBC: Low Back Pain: Exercises to Reduce Pain](#)

Appropriate Use of MRI for Hip and Knee Pain in Adults Age ≥ 40

Objective: to guide decision-making regarding whether MRI is needed in a patient ≥ age 40 presenting to primary care or the emergency department with hip or knee pain and osteoarthritis in the subject joint.

Rationale: The purpose of an MRI for knee or hip is primarily for surgical planning. In most cases, using MRI does not add useful information for patients with moderate-to-severe OA especially for those with chronic degenerative conditions.

A weight-bearing x-ray is recommended to identify OA.

Recommendation: In the absence of red flags, acute or chronic hip or knee pain with plain film x-ray evidence of moderate-to-severe osteoarthritis OA does not require MRI. MRI should be reserved for evaluation of possible red flag diagnoses or common conditions treatable with arthroscopy, e.g., meniscus and ligamentous tears.

► MRI Knee and Hip Appropriateness Criteria

For patients 40 years of age and older, one of the following red flags must apply in order to be eligible for MRI knee or hip:

- MRI was recommended on a previous imaging report (please attach report)
- Previous knee or hip surgery*
- Suspected infection*
- Suspected tumour
- Osteonecrosis
- Fixed locked knee*
- 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

*Knee or hip pain in the settings of previous surgery, suspected infection, or fixed locked knee may be urgent or emergent. Consider discussion with an orthopedic surgeon prior to requesting an MRI. All orthopedic emergencies require immediate consultation.

Key messages for counselling patients:

- Having an x-ray can inform the appropriate investigation pathway.
- In absence of red flag symptoms, there is no evidence for the utility of MRI in patients with significant OA.
- Most orthopaedic surgeons do not require obligatory MRI prior to consultation. If an MRI is required, the surgeon can request it.
- Discuss options for treatment and pain management including a trial of acetaminophen and NSAIDs.

Patient and caregiver resources

[MRI for Knee and Hip – when is it appropriate? Information for patients](#) (Vancouver Coastal Health)

► Practitioner Resources

- **RACE Line:** raceconnect.ca
 - o A telephone consultation line for select specialty services for physicians, nurse practitioners and medical residents. If the relevant specialty area is available through your local RACE line, please contact them first. Contact your local RACE line for the list of available specialty areas. If your local RACE line does not cover the relevant specialty service or there is no local RACE line in your area, or to access Provincial Services, please contact the Vancouver Coastal Health Region/ Providence Health Care RACE line.
 - o Vancouver Coastal Health Region/Providence Health Care: raceconnect.ca or 604-696-2131 or 1-877-696-2131
 - o Northern RACE: 1-877-605-7223 (toll free)
 - o Kootenay Boundary RACE: divisionsbc.ca/kootenay-boundary/our-impact/team-based-care/race-line 1-844-365-7223 (toll free)
 - o Fraser Valley RACE: raceapp.ca
 - o South Island RACE: raceapp.ca or see divisionsbc.ca/south-island/race
- **Pathways:** pathwaysbc.ca
 - o An online resource that allows GPs and nurse practitioners and their office staff to quickly access current and accurate referral information and wait times for specialists and specialty clinics. Pathways also has hundreds of patient and physician resources that are categorized and searchable.
- **BC Emergency Medicine Network:** bcemergencynetwork.ca
 - o Includes practitioner resources, point-of-care clinical summaries, and patient handouts.
- **Lower Mainland Medical Imaging MRI Central Intake Program:** vch.ca/for-health-professionals/resources-updates/mri-central-intake

► Associated Documents

- BC Guideline: [Ultrasound Prioritization](#)
- BC Guideline: [Ankle Injury – X-Ray for Acute Injury of the Ankle or Mid-Foot](#)

How this guideline was developed

The five recommendations in this guideline were agreed to by a provincial expert advisory group on medical imaging in British Columbia.¹³ The recommendations were developed by consensus to decrease the rate of inappropriate medical imaging.¹³ They are informed by the Canadian Association of Radiologists (CAR) Choosing Wisely Canada Top 5 recommendations.¹

Where available, key references are provided. In situations where there is a lack of rigorous evidence, we provide best clinical opinion to support decision making and high-quality patient care. For more information about how BC Guidelines are developed, refer to the GPAC Handbook available at BCGuidelines.ca: [GPAC Handbook](#).

► References

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This guideline is based on scientific evidence current as of the effective date.

The guideline was developed by the Guidelines and Protocols Advisory Committee and adopted 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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