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Computed Tomography (CT) Prioritization

Effective Date: September 16, 2020

Scope

This guideline summarizes suggested wait times for common indications where Computed Tomography (CT) 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) CT 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 CT Prioritization Guidelines were developed to provide imaging departments with a consistent, provincial approach to prioritizing commonly ordered CT 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 Magnetic Resonance Imaging (MRI) 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 CT and the ability to respond to CT requests will depend on resources and 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 CT 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

CT is widely indicated for and includes but is not limited to the following[4] (see separate sections for specific clinical indications):

- Cerebrovascular accidents
- Imaging in trauma
- Staging and monitoring of malignancies
- Imaging of the chest and abdominal conditions
- Providing pre-operative assessment of complex masses
- Assessing post-operative complications
- Imaging guided intervention: injections, fine needle aspiration, core biopsy and fluid drainage

The following potential diagnoses, where CT is the recommended first test, are grouped according to body 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 CT may be less appropriate due to ionizing radiation exposure.

For CT also consider the patient risk of radiation exposure, refer to Appendix A: Radiation Exposure.

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**	
• Acute trauma to head, facial bones, spine and orbit (e.g. foreign body) • Decreased or altered level of consciousness • Stroke / Transient Ischemic Attack (TIA) • Acute thunderclap headache: suspected acute subarachnoid hemorrhage • Intracranial venous thrombosis • Acute infection – neck or intracranial • Dissection - Carotid or Vertebral • Acute orbital mass or inflammation with imminent visual loss	• Head and neck malignancy – pre-operative, and/or staging • Post-operative neurosurgical patients • Orbital pathology including new visual symptoms, and/or acute proptosis • Evaluate rapid deterioration in patient with known malignant disease • Headaches (recently worsening or with neurological findings), red flags • Seizures, 1st documented • Vertebrobasilar insufficiency	• Sellar pathology (if MRI not possible) • Hearing loss or tinnitus • Pulsatile tinnitus • Acute Psychosis – 1st episode	• Screening for intracranial aneurysms – family history Computed Tomography Angiography (CTA) • Mild cognitive impairment / Dementia work-up • Sinus disease without intracranial complication • Temporomandibular Joint (TMJ) pathology • Cholesteatoma, chronic otitis media	• Hematoma – reassessment of known chronic subdural • Postoperative follow-up (i.e. meningioma resection, pituitary adenoma)

Head and Neck: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Stroke / Transient Ischemic Attack (TIA)	• CT head is usually combined with CTA and perfusion imaging when acute stroke is suspected • CTA (or carotid US) should be considered when TIA suspected, may not be performed on emergent basis
	Acute thunderclap headache acute: suspected acute subarachnoid hemorrhage	• CTA should be considered
P2	Postoperative neurosurgical patients	• Typically ordered by a Neurosurgeon
	Headaches (recently worsening or neurological findings), red flags	• Please see the listing of red flags in the red table below or refer to the Appropriate Imaging for Common Situations in Primary and Emergency Care[5]
P3	Pulsatile tinnitus	• CT is the preferred test • MRI suggested for sensorineural hearing loss
	Acute Psychosis – 1st episode	• Expedited as per specialist (i.e. psychiatry) request
P4	Postoperative follow-up (i.e. meningioma resection, pituitary adenoma Rx)	• Date of imaging determined by the referring specialist

Appropriate Imaging for Common Situations in Primary and Emergency Care[5]	
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 • New headache aged >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	Think twice before requesting head CT for: • Migraine • Syncope • Temporal arteritis • Multiple sclerosis • Sinusitis • Chronic post-concussion syndrome with normal neurological exam

Spine

Spine: Overview				
P1	**P2**	**P3**	**P4**	**P5**
Immediately to 24 hours	**Max 7 calendar days**	**Max 30 calendar days**	**Max 60 calendar days**	
• Acute spinal trauma • Acute myelopathy, (cord compression, cauda equina syndrome) • Discitis / osteomyelitis, suspected	• Evaluation of rapidly deteriorating malignant disease • Sciatica with progressive neurological deficit • Back pain with red flags • Spinal stenosis with bowel or bladder dysfunction	• Persistent neck or back pain of more than six weeks, after trial of conservative treatment, with or without objective neurological findings (radiculopathy)	• Postoperative spine with chronic pain	• Postoperative follow-up

Spine: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Acute myelopathy (cord compression, cauda equina syndrome)	• MRI usually preferred for cervical spine assessment
	Discitis / osteomyelitis, suspected	• If MRI contraindicated or not available
P2	Back pain with red flags	• Please see the listing of red flags in the red table below or refer to the Appropriate Imaging for Common Situations in Primary and Emergency Care.[5]
P3	Persistent back pain of more than six weeks, with or without objective neurological findings (radiculopathy)	• 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 Care[5]

Appropriate Imaging for Common Situations in Primary and Emergency Care[5]
Back Pain Imaging is not recommended unless red flags are present
Consider imaging in the following red flag situations: • 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**	
• Acute fractures with inconclusive plain X-rays, or for preoperative evaluation by an Orthopedic surgeon • Necrotizing fasciitis • Acute vascular insufficiency to extremity	• Fractures without neurovascular compromise, decision regarding surgery or for surgical planning • Assess postoperative complications, hardware or fracture alignment • Osteomyelitis (if MRI contraindicated) • Tumor – primary bone or soft tissue • Tumor musculoskeletal – biopsy planning • Unstable metastatic bone lesion	• Orthopedic preoperative planning (not P2) • Assess progress of fracture healing	• Characterization of arthritis, gout • Assessment of painful prosthesis • Monitoring of multiple myeloma, bone metastases where radiographs are inadequate • Evaluation of chronic vascular insufficiency	• Postoperative follow-up

Musculoskeletal/Extremity: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Acute vascular insufficiency to extremity	• CTA
P2	Tumor musculoskeletal - biopsy	• Only after evaluation with MRI and orthopedic oncology consultation
P3	Assess progress of fracture healing	• CT indicated If plain film is inconclusive
P4	Characterization of arthritis, gout	• Dual energy CT can be used for the characterization of crystalline arthropathies (if available)
	Evaluation of chronic vascular insufficiency	• CTA

Chest

Chest: Overview				
P1	**P2**	**P3**	**P4**	**P5**
Immediately to 24 hours	**Max 7 calendar days**	**Max 30 calendar days**	**Max 60 calendar days**	
• Major trauma • Acute aortic dissection • Acute pulmonary embolism (in pregnancy, see notes) • Esophageal rupture or tear • Mediastinitis • Massive hemoptysis	• Rapidly progressive shortness of breath (without a known underlying etiology) • Hemoptysis, increasing in frequency and volume • Acute interstitial lung disease • Further characterization of mediastinal, lung or pleural mass • Lymphadenopathy (hilar, mediastinal) • Evaluating atypical lung or pleural infection and symptomatic patients with a cough • High clinical suspicion for pneumonia/infection with a normal chest radiograph • Clinical deterioration if post lung transplant or immunocompromised	• Non-resolving pneumonia on chest X-ray • Chronic interstitial lung disease – acute exacerbation	• Chronic Interstitial lung disease – evaluation of progression • Bronchiectasis • Characterization of small pulmonary nodule • Evaluation for lung cancer in high risk individuals*	• Postoperative follow-up • Follow-up of small pulmonary nodule • Stable aneurysm / dissection follow-up

Chest: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Acute pulmonary embolism (in pregnancy, see notes)	• Local imaging consultation is recommended
P2	Acute interstitial lung disease	• New diagnosis or deterioration of existing disease • Acute exacerbation, deteriorating or clinical change
	Evaluating atypical lung or pleural infection and symptomatic patients with a cough	• Chest x-ray may be normal, typically CT required if not responding to regular treatment
	High clinical suspicion for pneumonia/infection with a normal chest radiograph	• Atypical infection (e.g. fungal)
	Clinical deterioration if lung Transplant or immunocompromised	• Complication, deterioration, change in respiratory status
P4	Evaluation for lung cancer in high risk individuals	• *The BC Lung Screen Trial provides lung cancer screening to BC residents who meet certain eligibility criteria http://www.bccancer.bc.ca/our-research/participate/lung-health/
P5	Follow-up of small pulmonary nodule	• Typically following the Fleischner Guidelines (see resources section)
	Stable aneurysm/dissection follow-up	• Without chest X-ray or symptomatic changes • Usually requested by specialists

Cardiac

Cardiac: Overview				
P1	**P2**	**P3**	**P4**	**P5**
Immediately to 24 hours	**Max 7 calendar days**	**Max 30 calendar days**	**Max 60 calendar days**	
• Acute/ unstable infective endocarditis • Suspected prosthetic valve dehiscence	• Chest pain (typical / atypical in high risk patient) (Coronary CTA) • Stable suspected infective endocarditis • Myo-/pericarditis (MRI contraindicated) • Ventricular assist device evaluation	• Atypical chest pain in low risk patient (Coronary CTA) • CT myocardial perfusion for ischemia (MRI contraindicated) • Atrial fibrillation pre-ablation work-up • Valve replacement work-up (TAVR / TMVR)	• Coronary artery calcium score • Follow-up pericardial effusion • Chest pain after coronary artery bypass graft (CABG)	• Postoperative follow-up

Cardiac: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Acute/ unstable infective endocarditis	• Echocardiography would be the best first test
P2	Chest pain (typical / atypical in high risk patient)	• Coronary CTA
	Stable suspected infective endocarditis	• Echocardiography would be the best first test
	Myo-/pericarditis (if MRI is contraindicated)	• Echocardiography would be the best first test
	Ventricular assist device evaluation	• LVAD/RVAD/BiVAD
P3	Atypical chest pain in low risk patient (CCTA)	• Coronary CTA
	CT myocardial perfusion for ischemia (MRI contraindicated)	• Usually ordered by specialists; performed at specialist sites
	Valve replacement workup (TAVR / TMVR)	• Usually ordered by specialists; performed at specialist sites

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**	
• Abdominal trauma • Abdominal aortic aneurysm rupture • Appendicitis • Diverticulitis • Bowel obstruction • Suspected bowel perforation • Bowel ischemia • Acute GI bleeding • Renal colic • Cholecystitis or biliary obstruction • Solid organ abscess/ infection or collection • Pelvic inflammatory disease • Post-operative complications • Suspected hernia, with acute symptoms	• Metastasis preoperative workup • Tumor – search for primary in the abdomen/ pelvis • Pancreatitis complications • Malignant disease; staging prior to treatment or evaluation if concern regarding progression • Solid organ masses (intra-abdominal, pelvic for further characterization) • Workup of asymptomatic abdominal mass • Renal or liver transplant complications	• Renal mass to determine whether a cyst or tumor • Adrenal mass, work-up of incidental finding • Pre-operative evaluation of aneurysms • Suspected tumor recurrence • Unexplained bloating, anemia, chronic abdominal pain or weight loss • Inflammatory bowel disease • Chronic mesenteric ischemia	• Colonic polyps • Hernia without acute symptoms • Renal stone burden • Renal artery stenosis	• Follow-up of treated malignancy • Follow-up for aneurysm growth • Postoperative follow-up

Abdomen and Pelvis: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Abdominal trauma	• Blunt or penetrating trauma
	Abdominal aortic aneurysm rupture	• Performed with a CTA protocol
	Appendicitis	• US is preferred first imaging examination particularly in pediatric, pregnant or young female patients
	Suspected bowel perforation	• Water-soluble oral contrast may assist in locating site of possible perforation
	Cholecystitis or biliary obstruction	• Can be considered if US inconclusive
	Pelvic inflammatory disease	• Ultrasound is usually the first test
P2	Solid organ masses (intra-abdominal or pelvic for characterization)	• MRI is a helpful adjunct particularly for pelvic masses
	Renal or liver transplant complications	• US usually the initial test • CT for inconclusive results
P3	Adrenal mass, work-up of incidental finding	• MRI can be considered if CT inconclusive • Correlation with endocrinology profile recommended
P4	Colonic polyps	• CT Colonography is indicated for patients who have had a positive FIT, an incomplete colonoscopy, who have contraindications for colonoscopy or preference for CTC
	Hernia without acute symptoms	• US is first-line test for acute painless hernia/chronic hernia
	Renal stone burden	• First line test is usually US, which may be supplemented with CT KUB (kidney, urinary, bladder) or KUB radiograph as needed
	Renal artery stenosis	• Performed as a CTA
P5	Follow-up of treated malignancy	• Usually booked as P5 as determined by the referring practitioner

Pediatric

Consider alternatives to CT, if appropriate, to reduce radiation exposure for pediatric patients. See Appendix A: Radiation Exposure, for more information.

Pediatric: Overview				
P1	**P2**	**P3**	**P4**	**P5**
Immediately to 24 hours	**Max 7 calendar days**	**Max 30 calendar days**	**Max 60 calendar days**	
• Major trauma • Non-accidental trauma suspected, with neurological syndrome • Stroke • Anterior Mediastinal Mass	• Chest / Abdominal Mass evaluation and staging • Infection – immune-compromised patient • Congenital Heart Disease (see notes) • Complex intra-articular fracture	• Headache with red flags	• Orthopedic reconstruction preoperative imaging • Craniosynostosis • Congenital Lung Anomaly (see notes)	• Postoperative follow-up

Pediatric: Notes and Alternative Tests		
	Potential Diagnosis	**Notes and Alternative Tests**
P1	Non-accidental trauma suspected, with acute neurological syndrome	• P1 if acute neurological syndrome • Otherwise P2 with MRI as alternative
	Stroke	• Requires CT/CTA +/- perfusion imaging
	Anterior Mediastinal Mass	• Requires clinical evaluation for airway compression
P2	Chest, Abdominal mass evaluation and staging	• MRI, 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	• P2-P4 depending on indication; should be referred to Pediatric Cardiology for evaluation; imaging is performed at BC Children's Hospital
P3	Headache with red flags	• MRI is alternative test • Typically ordered by a Pediatrician • If red flags are present. Please see the listing of red flags in the red table for headaches in the Head and Neck section of this guideline or refer to the Appropriate Imaging for Common Situations in Primary and Emergency Care[4]
P4	Craniosynostosis	• Best ordered in consultation with a Pediatrician or Neurosurgeon prior to imaging
	Congenital Lung Anomaly	• P2 if patient is symptomatic; after 6 months of age if asymptomatic

Resources

- American College of Radiology Appropriateness Criteria
  https://www.acr.org/Quality-Safety/Appropriateness-Criteria
- 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
- 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
- CAR Standard for Magnetic Resonance Imaging (2011)
  https://car.ca/wp-content/uploads/Magnetic-Resonance-Imaging-2011.pdf
- Choosing Wisely Radiology Recommendations for 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/
- HealthlinkBC, Radiation Exposure: Risk and Health Effects
  https://www.healthlinkbc.ca/health-topics/abl0600
- Image Gently: Pediatric Radiology & Imaging
  https://www.imagegently.org/
- 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
- National Cancer Institute
  https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/pediatric-ct-scans
- 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

Appendices

- Appendix A: Radiation Exposure

References

1. BC Radiological Society. *CT 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 Computed Tomography 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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Disclaimer

Appendix A: Radiation Exposure

Radiation exists in the natural environment and this natural background radiation may vary based on location.

Sources and Average Effective Dose from Natural Background Radiation in Selected Canadian Cities[1]					
Canadian City	**Total (mSv/y)**	**Cosmic radiation (mSv/y)**	**Terrestrial background (mSv/y)**	**Annual inhalation dose (mSv/y)**	**Radionuclides in the body (mSv/y)**
CANADA	1.8	0.3	0.2	0.9	0.3
Vancouver	1.3	0.5	0.1	0.4	0.3
Victoria	1.8	0.5	0.1	0.9	0.3

Sources: Gratsky et al., 2004, UNSCEAR 2008, Geological Survey of Canada

Ionizing radiation is used during a CT scan to produce the image. CT scans are about as much radiation as 200 chest x-rays.[2] Living at high altitude for a year would be the same as having four chest x-rays.[2] A ten-hour plane flight is about the same amount of radiation as one chest x-ray.[2]

The risk of an adult getting cancer from a CT scan is about 1 in 1000.[2] However, large studies have found some slight increases in cancer risk due to radiation exposure that is more pronounced amongst children.[3] For this reason, children's medical imaging scans in particular try to follow the ALARA principle (As Low As Reasonably Achievable), to obtain images at the lowest dose of radiation possible.[4]

Image Gently Campaign's strategies to minimize radiation risk for children:[3]

- Image when there is a clear medical benefit
- Use the lowest amount of radiation for adequate imaging based on the size of the child
- Image only the indicated area
- Avoid multiple scans
- Use alternative diagnostic studies that do not use radiation (such as ultrasound or MRI) when possible.

References

1. Canadian Nuclear Safety Commission. *Radiation Doses*. http://nuclearsafety.gc.ca/eng/resources/radiation/introduction-to-radiation/radiation-doses.cfm
2. HealthLink BC. *Radiation Exposure: Risk and Health Effects*. https://www.healthlinkbc.ca/health-topics/abl0600
3. Image Gently. *What Parents Should Know about Medical Radiation Safety* (brochure). https://www.imagegently.org/Portals/6/Procedures/Image_Gently_8.5x11_Brochure.pdf
4. Image Wisely. *Pediatric CT and Image Gently*. https://www.imagewisely.org/Imaging-Modalities/Computed-Tomography/Pediatric-CT-and-Image-Gently