Revised 2019 (Resolution 3)*

ACR–SAR–SCBT-MR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) COLONOGRAPHY IN ADULTS

PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care[1].For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the practitioner considering all the circumstances presented. Thus, an approach that differs from the guidance in this document, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in this document when, in the reasonable judgment of the practitioner, such course of action is indicated by variables such as the condition of the patient, limitations of available resources, or advances in knowledge or technology after publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document may consider documenting in the patient record information sufficient to explain the approach taken.

The practice of medicine involves the science, and the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to the guidance in this document will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The purpose of this document is to assist practitioners in achieving this objective.

[1] Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing 831 N.W.2d 826 (Iowa 2013) Iowa Supreme Court refuses to find that the *ACR Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures* (Revised 2008) sets a national standard for who may perform fluoroscopic procedures in light of the standard's stated purpose that ACR standards are educational tools and not intended to establish a legal standard of care. See also, Stanley v. McCarver, 63 P.3d 1076 (Ariz. App. 2003) where in a concurring opinion the Court stated that "published standards or guidelines of specialty medical organizations are useful in determining the duty owed or the standard of care applicable in a given situation" even though ACR standards themselves do not establish the standard of care.

I. INTRODUCTION

Computed tomography colonography (CTC) is a minimally invasive structural examination of the colon and rectum to evaluate for colorectal polyps and neoplasms [1-13]. The goal of this examination is to establish the presence or absence of colorectal neoplasia by producing a diagnostic-quality study at the lowest feasible radiation dose. This practice parameter outlines the performance of CTC in adult patients.

Individuals undergoing this examination may fall into one of several risk populations, and the examination may be designated as screening, surveillance, or diagnostic. There are several evidence-based guidelines that, with minor variations, categorize individuals into specific risk groups with correlated recommendations for management [14-17].

Screening identifies individuals who have colorectal cancer or adenomatous polyps without signs or symptoms of the disease. Individuals without other risk factors are at average risk. The American Cancer Society (ACS) recommends screening begin at age 45, whereas the United States Preventive Services Task Force (USPSTF) recommends that screening begin at age 50 in average-risk individuals [18]. Individuals with a single first-degree relative (mother, father, sister, brother, or child) who have had colorectal neoplasia before age 60 or multiple first-degree relatives with colorectal neoplasia diagnosed at any age are defined as being at moderate risk. Average- and moderate-risk individuals are candidates for screening by CTC. Individuals with a longstanding history of inflammatory bowel disease or who are from families with defined genetic syndromes are at high risk and should not be considered for screening by CTC.

Surveillance involves the ongoing monitoring of people with previously diagnosed colorectal neoplasia identified as belonging to the high-risk category. The degree of risk may be related to the underlying or prior pathology. Surveillance CTC is also performed on individuals in whom colonic polyps have been previously identified but not resected in order to assess stability of lesions that are considered low risk.

Diagnostic CTC examinations are performed on symptomatic individuals or as a follow-up to a prior but less definitive screening study. These individuals, by definition, are considered to be at greater risk of harboring colorectal neoplasia.

II. INDICATIONS AND CONTRAINDICATIONS

A. Indications

The indications for a CTC examination include, but are not limited to, the following:

1. Screening examination in individuals who are at average or moderate risk for developing colorectal carcinoma. Screening of individuals who are at moderate risk for colorectal cancer may be managed individually based on clinical context or local practice patterns.
2. Surveillance examination in patients with a history of previous colonic neoplasm [19], depending on the appropriate clinical context.
3. Diagnostic examination in symptomatic patients, particularly in the setting of incomplete colonoscopy, including, but not limited to, those with the following:
    a. Abdominal pain
    b. Diarrhea
    c. Constipation
    d. Gastrointestinal bleeding
    e. Anemia
    f. Intestinal obstruction
    g. Weight loss
4. Following incomplete screening, surveillance, or diagnostic colonoscopy and for characterization of colorectal lesions indeterminate on optical colonoscopy [20-24].
5. Patients who may be at increased risk for complications during optical colonoscopy (eg, advanced age, anticoagulant therapy, sedation risk, prior incomplete colonoscopy).

6. Follow-up of patients with a colonic stoma or after colectomy. Intubation of the stoma should be performed with caution to avoid colonic injury or perforation [25-27].
7. Prior to surgery for colorectal cancer in order to accurately localize the tumor or search for synchronous lesions.

B. Contraindications

1. The relative contraindications or conditions that require caution in performing a CTC examination include, but are not limited to, the following:
   a. Symptomatic acute colitis
   b. Acute diarrhea
   c. Recent acute diverticulitis
   d. Recent colorectal surgery
   e. Symptomatic colon-containing abdominal wall hernia
   f. Recent deep endoscopic biopsy or polypectomy/mucosectomy
   g. Known or suspected colonic perforation
   h. Symptomatic or high-grade small bowel obstruction
2. CTC is not indicated for the following:
   a. Routine follow-up of inflammatory bowel disease
   b. Hereditary polyposis or nonpolyposis cancer syndromes
   c. Evaluation of anal canal disease
   d. The pregnant or potentially pregnant patient (refer to the ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Patients with Ionizing Radiation [28])

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [29]

A. Physician

The physician shall be responsible for all aspects of the study. The responsibilities include, but are not limited to, reviewing all indications for the examination; specifying and monitoring the appropriate patient preparation for colonic cleansing prior to the examination; specifying the appropriate imaging protocol, the methods of image reconstruction, and the use and dosage of contrast and pharmacologic agents; interpreting all resulting images and generating an official report (recommended with the use of Colonography Reporting and Data System (C-RADS) and Extracolonic reporting and data systems (E-RADS) classification [30]); and ensuring the quality of the images and the interpretation.

Initial Training

1. For physicians with prior qualifications in general and/or abdominal-pelvic CT interpretation:

   The radiologist or other physician who meets the qualifications of the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [31] will have substantial knowledge of radiation biology; the physics of CT scanning include radiation dose lowering CT scanning techniques; the principles of CT image acquisition and postprocessing and the use of diagnostic workstations; and the design of CT protocols, including rate and timing of contrast administration. The physician also will have substantial experience in CT interpretation, including CT of extracolonic structures that will be included on the CTC examination.

   Supervising and interpreting physicians with prior qualifications in general and/or abdominal-pelvic CT interpretation shall also meet ONE of the following requirements (the supervising physician must have met initial qualifications):

a. For physicians who receive their training in CTC in a training program approved by the Accreditation Council for Graduate Medical Education (ACGME), the Royal College of Physicians and Surgeons of Canada, the Collège des Médecins du Québec, or the American Osteopathic Association, such training shall include the following:
   i. Education regarding patient preparation, bowel insufflation, and CT image acquisition.

   and

   ii. Formal hands-on interactive training using dedicated CTC software, including the interpretation, reporting, and/or supervised review of at least 50 endoscopically confirmed CTC cases using primary 2-D and/or primary 3-D search with application of routine problem-solving techniques.

   Ideally this collection of training cases will be chosen to demonstrate the gamut of appearances of colonic polyps and cancer and CTC interpretation pitfalls. Additionally, the cases should include examinations performed for a variety of indications (eg, screening, symptomatic, incomplete colonoscopy with subsequent validation) and acquisition techniques (eg, with and without fluid tagging and intravenous (IV) contrast).

   or

b. For physicians who receive their training in CTC after completing their residency or fellowship, such training shall include the following:

   i. Education regarding patient preparation, bowel insufflation, and CT image acquisition.

   and

   ii. Formal hands-on interactive training using dedicated CTC software, including the interpretation, reporting, and/or supervised review of at least 50 endoscopically confirmed CTC cases using primary 2-D and/or primary 3-D search employing commonly used problem-solving techniques.

   Ideally this collection of training cases will be chosen to demonstrate the gamut of appearances of colonic polyps and cancer and CTC interpretation pitfalls. Additionally, the cases should include examinations performed for a variety of indications (eg, screening, symptomatic, incomplete colonoscopy with subsequent validation) and acquisition techniques (eg, with and without fluid tagging and IV contrast).

2. For physicians who do not have prior qualifications in general and/or abdominal-pelvic CT interpretation:

   A radiologist or other physician who does not meet the qualifications of the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [31] or who meets these qualifications only for a specific anatomic area outside of the abdomen-pelvis, requires more extensive training and experience in CT scanning with an emphasis on the abdomen-pelvis and specific experience in CTC. In addition to specific training in imaging interpretation, this training must include knowledge of the principles of CT image acquisition and postprocessing, including the use of diagnostic workstations, the design of CT protocols, the rate and timing of contrast administration, and instruction on radiation dose lowering CT scanning techniques. The physician must also meet the same requirements, or document equivalent training, as those delineated in the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [31] with regard to knowledge of the physics of CT scanning and radiation biology. Some physicians will also require additional education in colon anatomy, physiology, and pathology.

   Supervising and interpreting physicians without prior qualifications in general and/or abdominal-pelvic CT interpretation shall meet the following requirements:

   a. Completion of sufficient training and experience to meet the qualifications of the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [31]. For a physician who assumes responsibilities for CT imaging exclusively in a specific anatomical area, such as abdominal-pelvic CT and CTC, this includes the following:

i. Completion of an ACGME-approved training program in their respective specialty in which they practice 200 plus hours of Category 1 CME in the performance and interpretation of abdominal-pelvic CT;

and

ii. Supervision, interpretation, and reporting of 500 CT cases, at least 100 of which must be abdominal-pelvic CT cases during the past 36 months in a supervised situation;

and

b. Education regarding patient preparation, bowel insufflation, and CT image acquisition;

and

c. Formal hands-on interactive training using dedicated CTC software, including the interpretation, reporting, and/or supervised review of at least 75 endoscopically confirmed CTC cases using primary 2-D and/or primary 3-D search with routine problem-solving techniques [32].

Ideally this collection of training cases will be chosen to demonstrate the gamut of appearances of colonic polyps and cancer and CTC interpretation pitfalls. Additionally, the cases should include examinations performed for a variety of indications (eg, screening, symptomatic, incomplete colonoscopy with subsequent validation) and acquisition techniques (eg, with and without fluid tagging and IV contrast).

Maintenance of Competence

When feasible, CTC training should be followed by a period of mentored supervision and double-reading by an experienced CTC-trained physician. A variety of other techniques may also be helpful for improving interpretive skills at CTC, including the following:

- Self-directed individual study of formal texts, atlases, review articles, and teaching files
- Testing with feedback
- Computer-aided detection algorithms, which can be used as a second reader

A total of 50 cases every 2 years should be reviewed to maintain skills in CTC. This can be accomplished in several ways, such as:

- Performance of CTC with primary or overread interpretations in local practice, with follow-up of positive findings with endoscopy or surgery
- CME-sponsored reviews online, DVDs, or at review courses where case interpretation precedes disclosure of the correct answers

B. Radiologic Technologist

Qualifications of the radiologic technologist should include familiarity with the technical requirements of performing CTC, including selection of scanning parameters, rectal tip insertion, proper patient positioning, colonic insufflation of room air and carbon dioxide with manual and automated techniques, tube removal, and quality assurance of the examination prior to discharge of the patient.

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for CT colonography should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). Additional information regarding the specific reason for the examination or a provisional

diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient's clinical problem or question and consistent with the state scope of practice requirements. (ACR Resolution 35, adopted in 2006 – revised in 2016, Resolution 12-b)

A. Colon Preparation

Preparation of the colon for CTC should include a combination of a cleansing laxative; tagging agent(s), such as barium to tag residual stool; and iodinated contrast material to tag remaining fluid [33]. The intent is to achieve a colon that is free of fecal material and excess fluid or as close to this ideal as possible [33-37]. The goal of tagging is to passively incorporate contrast into any residual fluid and stool in order to raise their inherent CT densities, which helps to discriminate these residua from the soft-tissue density of polyps or advanced cancers. Additionally, contrast surface coating can aid in polyp detection [38,39]. Magnesium citrate or polyethylene glycol are commonly used laxatives [33,37]. Preparations may also include a clear liquid diet the day before CTC [33].

Noncathartic or reduced-cathartic approaches to CTC bowel preparation (also known as "prepless" or "minimal prep" CTC) aim to reduce patient discomfort associated with pre-examination bowel purgation. Although data supporting the success of this approach continue to emerge, a fully cleansed colon is generally recommended for patients who can comply [40-43]. For patients who cannot comply with a standard preparation or who are too fragile to undergo a standard preparation, sufficient data exist to justify limited cathartic or noncathartic CTC when combined with a tagging agent [13,44-48].

B. Examination Technique

1. The medical history, including patient compliance with the colon preparation, should be reviewed.
2. The patient should evacuate prior to insertion of the rectal tube. A soft (nonrigid) tip tube is recommended.
3. The rectal tube tip should be inserted by a physician or a trained assistant (radiologic technologist, nurse, or physician assistant). If a rectal retention balloon is used, inflation should be discontinued if the patient complains of persistent severe pain. This may indicate an increased risk of perforation.
4. If a rectal retention balloon is used, it should be deflated or advanced on one series to facilitate detection of low lying rectal lesions.
5. The use of antispasmotics is not considered necessary for routine examination, and the evidence for improved distention or patient comfort remains inconclusive. No benefit is seen with glucagon [49,50]. There may be some benefit with hyoscine *N*-butylbromide [51,52]. However, this agent is currently unavailable in the United States.
6. The preferred method of colonic insufflation is by means of mechanical insufflation using carbon dioxide [53]; however, manual insufflation with room air is acceptable. A sufficient volume of carbon dioxide or room air should be administered either with an automatic insufflator or manually to provide full colon distention [54].
7. The adequacy of colon distention should be checked with a localizer to ensure a complete and full column of gas throughout the colon before each CT series acquisition.
8. Complete anatomic imaging of the colon and rectum should be obtained in at least two patient positions (such as supine and prone, supine and right lateral decubitus, or bilateral decubitus) [36,55,56]. Each series should be obtained in end expiration to minimize pressure effects of inflated lungs on the transverse colon. Addition of pillows beneath the chest and pelvis may also aid colonic distention on prone positioning.
9. Screening studies should be performed using a low-dose, nonenhanced CT technique on a multidetector CT (MDCT) scanner [3,57-60]. CTC studies should be performed such that there is appropriate adaptation of computed tomography dose index volume ($CTDI_{vol}$) to patient size, using either technique charts or automatic exposure control. The recommended radiation output $CTDI_{vol}$ for routine screening CTC for an average size subject should be 5mGy or less per position. Generally, for scans performed at a tube potential of 120 kVp, this requires an effective mAs value of approximately 50.

10. The use of dose reduction techniques is encouraged. These include reductions in tube current (mA), exposure time(s), tube current-time product (mAs), or tube potential (kV). Automatic exposure control systems, image-based noise reduction algorithms, and iterative reconstruction techniques can also be used to effectively reduce dose [61-63]. Using these strategies, much lower radiation doses for screening CTC per position can be achieved, similar to or less than the average annual background level of radiation in the range of 3 mSv or less [64].
11. Additional imaging after repositioning and reinsufflation may be needed to adequately distend a colonic segment. Additional imaging (eg, in right or left decubitus position) is appropriate when imaging in two positions fails to adequately display the colonic lumen and acquisition of additional data is likely to result in a diagnostic study [65]. Any additional imaging should be limited to the segment of interest in order to minimize additional radiation dose.
12. For morbidly obese patients, radiation dose should be appropriately increased to maintain diagnostic image quality [66].
13. Diagnostic CTC examinations should use the same CT parameters as screening CTC examinations. Diagnostic CTC may occasionally require IV contrast to characterize intracolonic or extracolonic structures or to address a second medical indication. When IV contrast is used, the dose on the contrast-enhanced series should be similar to a standard abdominal pelvic CT; the supine series is typically used for this. Thus, for diagnostic contrast-enhanced CTC, a typical order of sequences should include an initial low-dose noncontrast prone series followed by a supine series with IV contrast and normal dose.
14. CTC is optimally performed on a MDCT (≥16 slice) scanner. A section thickness of 1 to 1.25 mm with a reconstruction interval of ≤1 mm is optimal. The breathhold should not exceed 25 seconds.
15. Networking capability should be available to transfer the image data to a workstation with specialized software for CTC interpretation.

C. Quality Control

The following quality controls should be applied to all CTC examinations:

1. There should be complete anatomic coverage of the colon and rectum.
2. Colon cleansing and distention should be adequate for detecting polyps 1 cm or larger, at a minimum.
3. The luminal surface of each segment of the colon should be visualized in at least one position. Suboptimally visualized colonic segments should be reimaged. The use of lateral decubitus views or reinsufflation may be helpful in cases of suboptimal distention or excessive fluid [65].
4. Efforts should be made to ensure a diagnostic-quality examination before the patient leaves the facility.
5. The following is suggested for a quality control program:
    a. Radiologic, endoscopic, and pathologic findings should be correlated whenever available on a per patient basis.
    b. Detection rates for colorectal cancer and polyps of 1 cm or greater should be determined and periodically monitored. There should be an assessment of false-positive rates for all reported polyps in patients who undergo subsequent colonoscopy.
    c. Dose should be tracked as part of protocol optimization to follow “as low as reasonably achievable” (ALARA) principles.
    d. Participation in the ACR NRDR® CTC Registry (https://nrdr.acr.org/Portal/CTC/Main/page.aspx) is recommended, with regular comparison of facility data to national data to determine how local detection and complication rates compare with national rates and whether performance is adequate or if further internal review is indicated. Please note, the American Board of Radiology (ABR) has deemed that the CTC Registry meets the criteria for practice quality improvement toward the purpose of fulfilling requirements in the ABR Maintenance of Certification Program.

D. Data Interpretation

The purpose of CTC is to accurately evaluate the colon for the presence or absence of clinically significant neoplastic lesions. Abnormalities may range from discrete mucosal elevations or depressions (which may be malignant or at risk to become malignant) to infiltrating tumors. Lesion size, morphology (sessile, pedunculated, flat, mass), and segmental location should be reported.

1. Detection and characterization of colorectal findings
   Workstations utilized for CTC interpretation should be able to display 2-D and 3-D data as well as prone and supine data side by side for interactive interrogation. The software should also allow the interpreting physician to perform basic 2-D and 3-D functions interactively and in real time (ie, 2-D: change the window width and level settings, zoom/pan to area of interest, measure region of interest (ROI), measure distance, etc; 3-D: view object of interest from any angle, assess color map attenuation, measure size/volume, etc). The software should allow easy correlation of a specific point on the 2-D image with the same point on 3-D and the reverse situation.

   If an abnormality is suspected during either primary 2-D or 3-D searches:
   a. The abnormality should be interrogated with multiplanar reconstruction (MPR) and multiple endoluminal views to evaluate the morphology of the suspected lesion.
   b. Supine and prone data should be evaluated to determine if the lesion is mobile. Causes of mobility include residual fecal material, pedunculated polyp, or a rotating colon segment. Most true polyps can be identified in both the supine and prone views; potential lesions seen on only one view have a much lower predictive value.
   c. The window setting should be adjusted between colon and soft-tissue settings to determine if the lesion shows homogeneous soft-tissue attenuation or is heterogeneous.
2. Measurement of colorectal findings
   Polyps should be measured using optimized MPR (ie, axial, sagittal, or coronal view, which best elongates lesion) and/or 3-D images. Measurement of the size of the lesion should be based on the largest diameter of the polyp head (excluding stalk if present) or at the base of a sessile lesion [67,68].
3. Extracolonic findings
   Extracolonic structures should be evaluated at the time of the review of the colon. Significant or potentially significant abnormalities should be included in the report. A study optimized for evaluating colon abnormalities may not be optimal for detecting and characterizing extracolonic abnormalities. Specifically, detecting incidental findings with low subject contrast may be limited with aggressive dose reduction on unenhanced images. This limitation is reduced somewhat by increasing the section thickness for the extracolonic reconstruction (eg, 5-mm-thick sections at 3-mm intervals), which reduces noise and decreases the number of images that need to be reviewed for incidental lesion detection. Abnormalities or questionable abnormalities in structures unrelated to the colon may be identified during the process of reviewing the 2-D axial images of the colon. A balanced approach for recommending further workup of extracolonic findings should weigh the likelihood of a clinically important finding against the increased cost, patient anxiety, and potential complications related to additional evaluation [30,69].

V. DOCUMENTATION AND COMMUNICATION OF RESULTS

Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings [70].

Any colonic segment that cannot be adequately evaluated for technical reasons should be documented as such. Polyps ≥6 mm should be identified and reported. Consistent with the 2008 American Cancer Society recommendations [71], these patients should be offered polypectomy at colonoscopy, understanding that clinical management may vary depending on the patient's age, risk to undergo colonoscopy, other significant comorbidities, or the preference of the patient or the referring physician. Recommendations for clinical management options may be incorporated into the report. For patients with only 1 or 2 small (6-9 mm) polyps (ie, C-RADS C2), a 3-year surveillance CTC may be offered at some dedicated centers [30,72].

In patients with only diminutive polyps ≤5 mm, the risk of high-grade dysplasia or cancer is extremely low [6,10,73,74]. In fact, newer data show that cancer is virtually nonexistent in subcentimeter polyps [75,76]. Although there continues to be debate about patients with only diminutive polyps, the clinical risk of these diminutive polyps is extremely small [59,77,78]. The benefits of polypectomy versus 5-year surveillance need to be balanced with the broader risks, including the costs and complications of polypectomy. Namely, given the low risk of advanced neoplasia along with the low specificity of diminutive lesions at CTC, a large number of patients could be referred

to endoscopy inappropriately [79]. Furthermore at colonoscopy, concern over decreased productivity for false-positive CTC examinations has been raised [80], in addition to the low rate of detecting small lesions at colonoscopy [81,82]. Current CTC acquisition techniques targeted at the index lesion size of ≥6 mm with low-dose techniques do not always optimize detection of diminutive lesions. Given these considerations, the ACR currently does not believe that reporting of these diminutive lesions is necessary [30].

Extracolonic abnormalities of potential medical significance should also be reported. As with any CT scan, good patient care mandates that CTC interpretation include full evaluation of the numerous extracolonic structures and that findings of potential clinical significance be reported and communicated in a clear and timely fashion. However, most extracolonic findings are not clinically significant in screening/asymptomatic cohorts. In screening cohorts, the prevalence of clinically significant extracolonic findings is low [77,83-89]. Caution should be used in the interpretation and reporting of findings likely to be of low clinical significance in order to avoid unnecessary subsequent/serial diagnostic examinations and associated patient anxiety [30].

Clarity and consistency of reporting the colonic and extracolonic findings are critical for effective implementation. There is increasing use of the C-RADS, which is a consensus statement of a standardized reporting structure for CTC findings published in 2005, modeled after the Breast Imaging Reporting and Data System® (BI-RADS) reporting of mammography [30]. The reporting structure of C-RADS describes how to report lesion size, morphology, and location with a summary category score per patient.

VI. EQUIPMENT SPECIFICATIONS

Examinations should be performed with MDCT (generally ≥16 slice) equipment meeting all applicable federal and state radiation standards. The CT scanner should have the capability of providing section thicknesses of 1 to 1.25 mm and reconstruction intervals ≤1 mm at breathholds of less than 25 seconds. Equipment should provide diagnostic image quality and networking capability.

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, non-physician radiology providers**,** radiologic technologists, and all supervising physicians have a responsibility for safety in the workplace by keeping radiation exposure to staff, and to society as a whole, "as low as reasonably achievable" (ALARA) and to assure that radiation doses to individual patients are appropriate, taking into account the possible risk from radiation exposure and the diagnostic image quality necessary to achieve the clinical objective. All personnel who work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection, application of dose constraints and limits) and the principles of proper management of radiation dose to patients (justification, optimization including the use of dose reference levels). https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1775_web.pdf

Nationally developed guidelines, such as the ACR's Appropriateness Criteria®, should be used to help choose the most appropriate imaging procedures to prevent unnecessary radiation exposure.

Facilities should have and adhere to policies and procedures that require ionizing radiation examination protocols (radiography, fluoroscopy, interventional radiology, CT) to vary according to diagnostic requirements and patient body habitus to optimize the relationship between appropriate radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used, except when inappropriate for a specific exam. If such technology is not available, appropriate manual techniques should be used.

Additional information regarding patient radiation safety in imaging is available from the following websites – Image Gently® for children (www.imagegently.org) and Image Wisely® for adults (www.imagewisely.org). These advocacy and awareness campaigns provide free educational materials for all stakeholders involved in imaging (patients, technologists, referring providers, medical physicists, and radiologists).

Radiation exposures or other dose indices should be periodically measured by a Qualified Medical Physicist in accordance with the applicable ACR Technical Standards. Monitoring or regular review of dose indices from patient imaging should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry and relevant publications relying on its data, applicable ACR Practice Parameters, NCRP Report No. 172, Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States or the Conference of Radiation Control Program Director's National Evaluation of X-ray Trends; 2006, 2009, amended 2013, revised 2023 (Res. 2d).

VIII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR website (https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Quality-Control-and-Improvement).

For specific issues regarding CT quality control, see the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [31].

Equipment performance monitoring should be in accordance with the ACR–AAPM Technical Standard for Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment [90].

ACKNOWLEDGEMENTS

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Collaborative Committee
Members represent their societies in the initial and final revision of this practice parameter.

ACR	SAR	SCBT-MR
Judy Yee, MD, FACR, Chair	Cecelia Brewington, MD, FACR	Elizabeth G. McFarland, MD, FACR
Kevin J. Chang, MD	Perry J. Pickhardt, MD, FSAR	
Candice Johnstone, MD		
David H. Kim, MD, FACR		
Courtney Moreno, MD		

Colon Cancer Committee
(ACR Committee responsible for sponsoring the draft through the process)

Judy Yee, MD, FACR, Chair	Charles D. Johnson, MD, FACR
Matthew A. Barish, MD, FACR	David H. Kim, MD, FACR
Cecelia Brewington, MD, FACR	Mark E. Klein, MD, FACR
Kevin J. Chang, MD	Paul M. Knechtges, MD
Abraham H. Dachman, MD, FACR	Elizabeth G. McFarland, MD, FACR
Joel G. Fletcher, MD	Perry J. Pickhardt, MD, FACR
Marc J. Gollub, MD, FACR	Michael L. Puckett, MD, FACR
Mukesh G. Harisinghani, MD, BS, MB, FACR	Michael Zalis, MD, FACR

Committee on Practice Parameters – General, Small, Emergency and/or Rural Practices

(ACR Committee responsible for sponsoring the draft through the process)

Sayed Ali, MD, Chair
Marco A. Amendola, MD, FACR
Lynn Broderick, MD, FACR
Resmi A. Charalel, MD
Brian D. Gale, MD, MBA
Carolyn A. Haerr, MD
Charles E. Johnson, MD
Candice Johnstone, MD
Padmaja A. Jonnalagadda, MD
Steven E. Liston, MD, MBA, FACR
Tammam Nehme, MD
Samir S. Shah, MD
Jennifer L. Tomich, MD

Lincoln L. Berland, MD, FACR, Chair, Commission on Body Imaging
Robert S. Pyatt, Jr., MD, FACR, Chair, Commission on General, Small, Emergency and/or Rural Practice
Jacqueline Anne Bello, MD, FACR, Chair, Commission on Quality and Safety
Matthew S. Pollack, MD, FACR, Chair, Committee on Practice Parameters and Technical Standards

Comments Reconciliation Committee

Kevin Smith, MD, FACR, Chair
Timothy Crummy, MD, FACR, Co-Chair
Sayed Ali, MD
Jacqueline A. Bello, MD, FACR
Lincoln L. Berland, MD, FACR
Cecilia Brewington, MD, FACR
Kevin J. Chang, MD
Richard Duszak, Jr., MD, FACR
Candice Johnstone, MD
David H. Kim, MD, FACR
Paul A. Larson, MD, FACR
Barton Frederick Lane, MD
Elizabeth G. McFarland, MD, FACR
Courtney Moreno, MD
Mary S. Newell, MD, FACR
Perry J. Pickhardt, MD, FSAR
Matthew S. Pollack, MD, FACR
Robert S. Pyatt, Jr., MD, FACR
Timothy L. Swan, MD, FACR
Judy Yee, MD, FACR

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