

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

The American College of Radiology, with more than 40,000 members, is the principal organization of radiologists, radiation oncologists, and clinical medical physicists in the United States. The College is a nonprofit professional society whose primary purposes are to advance the science of radiology, improve radiologic services to the patient, study the socioeconomic aspects of the practice of radiology, and encourage continuing education for radiologists, radiation oncologists, medical physicists, and persons practicing in allied professional fields.

The American College of Radiology will periodically define new practice parameters and technical standards for radiologic practice to help advance the science of radiology and to improve the quality of service to patients throughout the United States. Existing practice parameters and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

Each practice parameter and technical standard, representing a policy statement by the College, has undergone a thorough consensus process in which it has been subjected to extensive review and approval. The practice parameters and technical standards recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published practice parameter and technical standard by those entities not providing these services is not authorized.

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 care¹. 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

This practice parameter was revised collaboratively by the ACR, the Society for Advanced Body Imaging (SABI), and the Society for Abdominal Radiology (SAR).

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 [14-16].

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 and the US Preventive Services Task Force recommend screening begin at age 45, in average-risk individuals [17,18]. 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, including those individuals with a preceding positive stool-based test or positive family history, 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. Iron deficiency 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. Before surgery for colorectal cancer to accurately localize the tumor or search for synchronous lesions.

II. INDICATIONS AND CONTRAINDICATIONS

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 colonoscopic 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

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-SPR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography \(CT\) \[29\]](#)

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

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 before 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 (Eclassification [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-SPR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography \(CT\) \[29\]](#) 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's interpretation experience should include CT interpretation 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 endoscopically confirmed CTC cases using primary 2-D and/or primary 3-D search with the 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 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 should demonstrate the gamut of appearances of colonic polyps, colorectal cancer and CTC interpretation pitfalls. Additionally, the cases should include examinations performed for a variety of indications (eg, screening, diagnostic, 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-SPR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography \(CT\)](#) [29] 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-SPR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography \(CT\)](#) [29] 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-SPR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography \(CT\) \[29\]](#). 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:

Physicians who supervise and interpret CT examinations should be licensed medical practitioners who have a thorough understanding of the indications for CT as well as a familiarity with the basic physical principles and limitations of the technology of CT imaging. They should be familiar with alternative and complementary imaging and diagnostic procedures and should be capable of correlating the results of these with CT findings. The physicians should have a thorough understanding of CT technology and instrumentation as well as radiation safety.

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

B. Physician

All examinations must be performed under the supervision of and interpreted by a physician who has the following qualifications:

Certification in Radiology, Diagnostic Radiology, or Interventional Radiology/Diagnostic Radiology by the American Board of Radiology, the American Osteopathic Board of Radiology, the Royal College of Physicians and Surgeons of Canada, or the Collège des Médecins du Québec, and engagement in the supervision, interpretation, and reporting of CT examinations in their clinical practice^[1]

Completion of a diagnostic radiology residency program approved by the ACGME, the Royal College of Physicians and Surgeons of Canada, the Collège des Médecins du Québec, or the American Osteopathic Association and engagement in the supervision, interpretation, and reporting of CT examinations in their clinical practice.

Physicians not board certified in radiology or not trained in a diagnostic radiology residency program who assume these responsibilities for CT imaging exclusively in a specific anatomical area should meet the following criteria: completion of an ACGME approved residency program in the specialty practiced plus category I CME in the performance and interpretation of CT in the subspecialty in which CT reading occurs; and engagement in the supervision, interpretation, and reporting of CT examinations in that subspecialty area.

1. The physician should have documented training in the physics of diagnostic radiology. Additionally, the physician must be familiar with the principles of radiation protection, the hazards of radiation, and radiation monitoring requirements and how they apply to both patients and personnel.
2. The physician should be thoroughly acquainted with the many morphologic and pathophysiologic manifestations demonstrated on CT, as well as common image artifacts. Additionally, supervising physicians should have appropriate knowledge of alternative imaging methods, including the use of and indications for general radiography, ultrasonography, MRI, nuclear medicine, and angiography.

3. The physician should be familiar with patient preparation for the examination. The physician must have had training in the recognition and treatment of adverse effects of contrast materials used for these studies. See the [ACR Manual on Contrast Media](#) and the [ACR-SPR Practice Parameter for the Use of Intravascular Contrast Media](#) [14,15].

and

4. The physician must have the responsibility for reviewing all indications for the examination; specifying the use, dosage, and rate of administration of contrast agents; specifying the imaging technique, including available techniques to reduce radiation dose; interpreting images; generating official interpretations (final reports); and maintaining the quality of the images and the interpretations.

Maintenance of Competence

Physicians must perform sufficient number of overall procedures to maintain their skills. Continued competence should depend on participation in a quality improvement program. Consideration should be given to the physician's lifetime practice experience.

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

Cases 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 in which case interpretation precedes disclosure of the correct answers

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

C. Radiologic Technologist

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

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for CTC 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)

IV. SPECIFICATIONS OF THE EXAMINATION

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 [32]. The intent is to achieve a colon that is free of fecal material and excess fluid or as close to this ideal as possible [32-36]. The goal of tagging is to passively incorporate contrast into any residual fluid and stool 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 [37,38]. Magnesium citrate and polyethylene glycol are commonly used laxatives [32,36]. Preparations may also include a clear liquid diet the day before CTC [32].

Noncathartic or reduced-cathartic approaches to CTC bowel preparation (also known as "preless" 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 [39-42]. 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 [13,43-47].

IV. SPECIFICATIONS OF THE EXAMINATION

B. Examination Technique

1. The medical history, including patient compliance with the colon preparation, should be reviewed.
2. The patient should evacuate before 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 antispasmodics is not considered necessary for routine examination, and the evidence for improved distention or patient comfort remains inconclusive. No benefit is seen with glucagon [48,49]. There may be some benefit with hyoscine *N*-butylbromide [50,51]. 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 [52]; 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 [53].
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) [35,54,55]. 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 [3,56-59]. CTC studies should be performed such that there is appropriate adaptation of CT 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 5 mGy 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 (milliamperere), exposure time(s), tube current-time product (milliamperere-seconds), or tube potential

(kilovolt). Automatic exposure control systems, image-based noise reduction algorithms, iterative reconstruction techniques, and deep learning image reconstruction techniques can also be used to effectively reduce dose [60-62]. 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 [63].

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 [64]. Any additional imaging should be limited to the segment of interest to minimize additional radiation dose.
12. For patients with morbid obesity, radiation dose should be appropriately increased to maintain diagnostic image quality [65].
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 CT of the abdomen and pelvis; the supine series is typically used for this. Thus, for diagnostic contrast-enhanced CTC, a typical order of sequences should include an initial low radiation-dose noncontrast prone series followed by a supine series with IV contrast and normal radiation.
14. CTC is optimally performed on an MDCT (=16 slice) scanner. A section thickness of 1–1.25 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.

IV. SPECIFICATIONS OF THE EXAMINATION

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 [64].
4. Total dose should fall in prescribed range set by institution to minimize exposure while maintaining diagnostic quality images for the detection of polyps 1 cm or larger.
5. Efforts should be made to ensure a diagnostic-quality examination before the patient leaves the facility.
6. 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. Regular peer learning meetings regarding CTC case outcomes are recommended.
 - 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 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.

IV. SPECIFICATIONS OF THE EXAMINATION

D. Data Interpretation

The main purpose of CTC is to accurately evaluate the colon and rectum for the presence or absence of clinically significant neoplastic lesions. Abnormalities may include polypoid and nonpolypoid lesions (which may be malignant or at risk to become malignant) and infiltrating tumors. Lesion size, morphology (sessile, pedunculated, flat, mass), and segmental location should be reported. Additionally, due to the cross-sectional CT nature of this examination, important findings outside of the colon should be assessed for and reported.

1. Detection and characterization of colorectal findings

Workstations used 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 in real time (ie, 2-D: change the window width and level settings, zoom/pan to area of interest, measure region of interest, measure distance, etc; 3-D: view object of interest from any angle, assess color map attenuation, measure size/volume, determine location, 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. This is a required core function for a CTC workstation because without this ability, true interactive interpretation cannot be done.

If an abnormality is suspected during either primary 2-D or 3-D searches:

The abnormality should be interrogated to confirm characteristics consistent with a true soft tissue polyp and to differentiate it from a pseudo-polyp typically related to tagged or untagged stool.

- a. Images of the individual in 2 or more positions 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 positions; potential lesions seen on only one view have a much lower predictive value.
- b. 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 [66,67].

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 [30,68].

V. DOCUMENTATION AND COMMUNICATION OF RESULTS

Reporting should be in accordance with the [ACR Practice Parameter for Communication of Diagnostic Imaging Findings](#) [69].

Clarity and consistency of reporting colonic and extracolonic findings are critical for effective implementation. The C-RADS is a standardized reporting structure for CTC findings, modeled after the Breast Imaging 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.

Any colonic segment that cannot be adequately evaluated for technical reasons should be documented as such. Polyps ≥ 6 mm should be identified and reported. 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 [30,71]. Follow-up colonoscopy is typically recommended if a polyp ≥ 10 mm is observed or if there are ≥ 3 polyps, each 6 - 9 mm [30].

In patients with only diminutive polyps ≤ 5 mm, the risk of high-grade dysplasia or cancer is extremely low [6,10,72,73]. In fact, newer data show that cancer is virtually nonexistent in subcentimeter polyps [74,75]. Although there continues to be debate about patients with only diminutive polyps, the clinical risk of these diminutive polyps is extremely small [58,76,77]. 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 [78]. 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 [76,82-88]. Caution should be used in the interpretation and reporting of findings likely to be of low clinical significance to avoid unnecessary subsequent/serial diagnostic examinations and associated patient anxiety [30].

VI. EQUIPMENT SPECIFICATIONS

Equipment performance monitoring should be in accordance with the [ACR–AAPM Technical Standard for Medical Physics Performance Monitoring of Computed Tomography \(CT\) Equipment](#) [89].

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 < 25 seconds. Equipment should provide diagnostic image quality and networking capability.

Dose reduction techniques, such as tube-current modulation, variable tube potential, and advanced reconstruction (eg, iterative and/or deep-learning based), should be used to reduce exposure to patients. Radiation monitoring techniques and the equipment to track radiation exposure should be used.

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-SPR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography \(CT\)](#) [29].

ACKNOWLEDGEMENTS

This practice parameter was revised according to the process described under the heading *The Process for Developing ACR Practice Parameters and Technical Standards* on the ACR website (<https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards>) by the ACR Colon Cancer Committee of the ACR Commission on General, Small, Emergency and/or Rural Practice.

Writing Committee – members represent their societies in the initial and final revision of this practice parameter

ACR

Yee, Judy MD, Chair

Brewington, Cecelia Cody MD

Chang, Kevin

Kim, David H MD

Moreno, Courtney Coursey MD

SAR

Dachman, Abraham MD

SABI

Dane, Bari MD

Committee on Colon Cancer

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

Yee, Judy MD, Chair

Larson, David B MBA, MD, Chair, Commission on Quality and Safety

Comments Reconciliation Committee

Rathi, Alisha MD - CSC, Co-Chair
Brewington, Cecelia Cody MD
Crummy, Timothy MD, MHA - CSC
Dane, Bari MD
Larson, David B MBA, MD
Schoppe, Kurt MD - CSC

Siebert, Derrick MD - CSC, Chair
Chang, Kevin
Dachman, Abraham MD
Kim, David H MD
Moreno, Courtney Coursey MD
Yee, Judy MD

REFERENCES

1. Fenlon HM, Nunes DP, Schroy PC, 3rd, Barish MA, Clarke PD, Ferrucci JT. A comparison of virtual and conventional colonoscopy for the detection of colorectal polyps. *N Engl J Med* 1999;341:1496-503.
2. Graser A, Stieber P, Nagel D, et al. Comparison of CT colonography, colonoscopy, sigmoidoscopy and faecal occult blood tests for the detection of advanced adenoma in an average risk population. *Gut* 2009;58:241-8.
3. Halligan S, Altman DG, Taylor SA, et al. CT colonography in the detection of colorectal polyps and cancer: systematic review, meta-analysis, and proposed minimum data set for study level reporting. *Radiology* 2005;237:893-904.
4. Johnson CD, Chen MH, Toledano AY, et al. Accuracy of CT colonography for detection of large adenomas and cancers. *N Engl J Med* 2008;359:1207-17.
5. Johnson CD, Harmsen WS, Wilson LA, et al. Prospective blinded evaluation of computed tomographic colonography for screen detection of colorectal polyps. *Gastroenterology* 2003;125:311-9.
6. Kim DH, Pickhardt PJ, Taylor AJ, et al. CT colonography versus colonoscopy for the detection of advanced neoplasia. *N Engl J Med* 2007;357:1403-12.
7. Laghi A, Iannaccone R, Carbone I, et al. Detection of colorectal lesions with virtual computed tomographic colonography. *Am J Surg* 2002;183:124-31.
8. Macari M, Bini EJ, Xue X, et al. Colorectal neoplasms: prospective comparison of thin-section low-dose multi-detector row CT colonography and conventional colonoscopy for detection. *Radiology* 2002;224:383-92.
9. Mulhall BP, Veerappan GR, Jackson JL. Meta-analysis: computed tomographic colonography. *Ann Intern Med* 2005;142:635-50.
10. Pickhardt PJ, Choi JR, Hwang I, et al. Computed tomographic virtual colonoscopy to screen for colorectal neoplasia in asymptomatic adults. *N Engl J Med* 2003;349:2191-200.
11. Pickhardt PJ, Nugent PA, Mysliwiec PA, Choi JR, Schindler WR. Location of adenomas missed by optical colonoscopy. *Ann Intern Med* 2004;141:352-9.
12. Yee J, Akerkar GA, Hung RK, Steinauer-Gebauer AM, Wall SD, McQuaid KR. Colorectal neoplasia: performance characteristics of CT colonography for detection in 300 patients. *Radiology* 2001;219:685-92.
13. Zalis ME, Blake MA, Cai W, et al. Diagnostic accuracy of laxative-free computed tomographic colonography for detection of adenomatous polyps in asymptomatic adults: a prospective evaluation. *Ann Intern Med* 2012;156:692-702.
14. Rex DK, Boland CR, Dominitz JA, et al. Colorectal Cancer Screening: Recommendations for Physicians and Patients from the U.S. Multi-Society Task Force on Colorectal Cancer. *The American journal of gastroenterology* 2017;112:1016-30.
15. Shaukat A, Kahi CJ, Burke CA, Rabeneck L, Sauer BG, Rex DK. ACG Clinical Guidelines: Colorectal Cancer Screening 2021. *The American journal of gastroenterology* 2021;116:458-79.
16. Patel SG, May FP, Anderson JC, et al. Updates on Age to Start and Stop Colorectal Cancer Screening: Recommendations From the U.S. Multi-Society Task Force on Colorectal Cancer. *Gastroenterology* 2022;162:285-99.
17. Wolf AMD, Fontham ETH, Church TR, et al. Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society. *CA Cancer J Clin* 2018.
18. Davidson KW, Barry MJ, Mangione CM, et al. Screening for Colorectal Cancer: US Preventive Services Task Force Recommendation Statement. *Jama* 2021;325:1965-77.
19. Kim HJ, Park SH, Pickhardt PJ, et al. CT colonography for combined colonic and extracolonic surveillance after curative resection of colorectal cancer. *Radiology* 2010;257:697-704.

20. Copel L, Sosna J, Kruskal JB, Raptopoulos V, Farrell RJ, Morrin MM. CT colonography in 546 patients with incomplete colonoscopy. *Radiology* 2007;244:471-8.
21. Fenlon HM, McAneny DB, Nunes DP, Clarke PD, Ferrucci JT. Occlusive colon carcinoma: virtual colonoscopy in the preoperative evaluation of the proximal colon. *Radiology* 1999;210:423-8.
22. Macari M, Berman P, Dicker M, Milano A, Megibow AJ. Usefulness of CT colonography in patients with incomplete colonoscopy. *AJR Am J Roentgenol* 1999;173:561-4.
23. Morrin MM, Farrell RJ, Raptopoulos V, McGee JB, Bleday R, Kruskal JB. Role of virtual computed tomographic colonography in patients with colorectal cancers and obstructing colorectal lesions. *Dis Colon Rectum* 2000;43:303-11.
24. Neri E, Giusti P, Battolla L, et al. Colorectal cancer: role of CT colonography in preoperative evaluation after incomplete colonoscopy. *Radiology* 2002;223:615-9.
25. Laghi A, Rengo M, Graser A, Iafate F. Current status on performance of CT colonography and clinical indications. *European journal of radiology* 2012.
26. Lee JH, Park SH, Lee SS, et al. CT colonography in patients who have undergone sigmoid colostomy: a feasibility study. *AJR Am J Roentgenol* 2011;197:W653-7.
27. Leonardou P, Striggaris K, Pappas P, et al. Screening of patients after colectomy: virtual colonography. *Abdominal imaging* 2006;31:521-8.
28. American College of Radiology. ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Patients with Ionizing Radiation. Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Pregnant-Pts.pdf>. Accessed January 13, 2023.
29. American College of Radiology. ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT). Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Perf-Interpret.pdf>. Accessed January 13, 2023.
30. Yee J, Dachman A, Kim DH, Kobi M, Laghi A, McFarland E, Moreno C, Park SH, Pickhardt PJ, Plumb A, Pooler BD, Zalis M, Chang KJ. CT Colonography Reporting and Data System (C-RADS): Version 2023 Update. *Radiology*. 2024 Jan;310(1):e232007.
31. Rockey DC, Barish M, Brill JV, et al. Standards for gastroenterologists for performing and interpreting diagnostic computed tomographic colonography. *Gastroenterology* 2007;133:1005-24.
32. Pickhardt PJ. Imaging and Screening for Colorectal Cancer with CT Colonography. *Radiol Clin North Am* 2017;55:1183-96.
33. Kim DH, Pickhardt PJ, Hinshaw JL, Taylor AJ, Mukherjee R, Pfau PR. Prospective blinded trial comparing 45-mL and 90-mL doses of oral sodium phosphate for bowel preparation before computed tomographic colonography. *J Comput Assist Tomogr* 2007;31:53-8.
34. Macari M, Lavelle M, Pedrosa I, et al. Effect of different bowel preparations on residual fluid at CT colonography. *Radiology* 2001;218:274-7.
35. Yee J, Kumar NN, Hung RK, Akerkar GA, Kumar PR, Wall SD. Comparison of supine and prone scanning separately and in combination at CT colonography. *Radiology* 2003;226:653-61.
36. Borden ZS, Pickhardt PJ, Kim DH, Lubner MG, Agriantonis DJ, Hinshaw JL. Bowel preparation for CT colonography: blinded comparison of magnesium citrate and sodium phosphate for catharsis. *Radiology* 2010;254:138-44.
37. Kim DH, Hinshaw JL, Lubner MG, Munoz del Rio A, Pooler BD, Pickhardt PJ. Contrast coating for the surface of flat polyps at CT colonography: a marker for detection. *European radiology* 2014;24:940-6.
38. Kim DH, Matkowskyj KA, Lubner MG, et al. Serrated Polyps at CT Colonography: Prevalence and Characteristics of the Serrated Polyp Spectrum. *Radiology* 2016;280:455-63.
39. Iannaccone R, Laghi A, Catalano C, et al. Computed tomographic colonography without cathartic preparation for the detection of colorectal polyps. *Gastroenterology* 2004;127:1300-11.
40. Lefere P, Gryspeerdt S, Marrannes J, Baekelandt M, Van Holsbeeck B. CT colonography after fecal tagging with a reduced cathartic cleansing and a reduced volume of barium. *AJR Am J Roentgenol* 2005;184:1836-42.
41. Zalis ME, Perumpillichira JJ, Magee C, Kohlberg G, Hahn PF. Tagging-based, electronically cleansed CT colonography: evaluation of patient comfort and image readability. *Radiology* 2006;239:149-59.
42. Fletcher JG, Johnson C.D, Welch T.J., et al. Optimization of CT colonography technique: prospective trial in

- 180 patients. *Radiology* 2000;216:704-11.
43. Florie J, van Gelder RE, Schutter MP, et al. Feasibility study of computed tomography colonography using limited bowel preparation at normal and low-dose levels study. *European radiology* 2007;17:3112-22.
 44. Jensch S, Bipat S, Peringa J, et al. CT colonography with limited bowel preparation: prospective assessment of patient experience and preference in comparison to optical colonoscopy with cathartic bowel preparation. *European radiology* 2010;20:146-56.
 45. Keedy AW, Yee J, Aslam R, et al. Reduced cathartic bowel preparation for CT colonography: prospective comparison of 2-L polyethylene glycol and magnesium citrate. *Radiology* 2011;261:156-64.
 46. Fletcher JG, Silva AC, Fidler JL, et al. Noncathartic CT colonography: Image quality assessment and performance and in a screening cohort. *AJR Am J Roentgenol* 2013;201:787-94.
 47. Sali L, Mascacchi M, Falchini M, et al. Reduced and Full-Preparation CT Colonography, Fecal Immunochemical Test, and Colonoscopy for Population Screening of Colorectal Cancer: A Randomized Trial. *J Natl Cancer Inst* 2016;108.
 48. Morrin MM, Farrell RJ, Keogan MT, Kruskal JB, Yam CS, Raptopoulos V. CT colonography: colonic distention improved by dual positioning but not intravenous glucagon. *European radiology* 2002;12:525-30.
 49. Yee J, Hung RK, Akerkar GA, Wall SD. The usefulness of glucagon hydrochloride for colonic distention in CT colonography. *AJR Am J Roentgenol* 1999;173:169-72.
 50. de Haan MC, Boellaard TN, Bossuyt PM, Stoker J. Colon distension, perceived burden and side-effects of CT-colonography for screening using hyoscine butylbromide or glucagon hydrochloride as bowel relaxant. *European journal of radiology* 2012;81:e910-6.
 51. Rogalla P, Lembcke A, Ruckert JC, et al. Spasmolysis at CT colonography: butyl scopolamine versus glucagon. *Radiology* 2005;236:184-8.
 52. Shinnors TJ, Pickhardt PJ, Taylor AJ, Jones DA, Olsen CH. Patient-controlled room air insufflation versus automated carbon dioxide delivery for CT colonography. *AJR Am J Roentgenol* 2006;186:1491-6.
 53. Burling D, Taylor SA, Halligan S, et al. Automated insufflation of carbon dioxide for MDCT colonography: distension and patient experience compared with manual insufflation. *AJR Am J Roentgenol* 2006;186:96-103.
 54. Chen SC, Lu DS, Hecht JR, Kadell BM. CT colonography: value of scanning in both the supine and prone positions. *AJR Am J Roentgenol* 1999;172:595-9.
 55. Pickhardt PJ, Bakke J, Kuo J, et al. Volumetric analysis of colonic distention according to patient position at CT colonography: diagnostic value of the right lateral decubitus series. *AJR Am J Roentgenol* 2014;203:W623-8.
 56. Iannaccone R, Laghi A, Catalano C, et al. Detection of colorectal lesions: lower-dose multi-detector row helical CT colonography compared with conventional colonoscopy. *Radiology* 2003;229:775-81.
 57. van Gelder RE, Venema HW, Florie J, et al. CT colonography: feasibility of substantial dose reduction--comparison of medium to very low doses in identical patients. *Radiology* 2004;232:611-20.
 58. van Gelder RE, Venema HW, Serlie IW, et al. CT colonography at different radiation dose levels: feasibility of dose reduction. *Radiology* 2002;224:25-33.
 59. Ginsburg M, Obara P, Wise L, Wroblewski K, Vannier MW, Dachman AH. BMI-based radiation dose reduction in CT colonography. *Academic radiology* 2013;20:486-92.
 60. Chang KJ, Yee J. Dose reduction methods for CT colonography. *Abdominal imaging* 2013;38:224-32.
 61. Flicek KT, Hara AK, Silva AC, Wu Q, Peter MB, Johnson CD. Reducing the radiation dose for CT colonography using adaptive statistical iterative reconstruction: A pilot study. *AJR Am J Roentgenol* 2010;195:126-31.
 62. Yoon MA, Kim SH, Lee JM, et al. Adaptive statistical iterative reconstruction and Veo: assessment of image quality and diagnostic performance in CT colonography at various radiation doses. *J Comput Assist Tomogr* 2012;36:596-601.
 63. Boellaard TN, Venema HW, Streekstra GJ, Stoker J. Effective radiation dose in CT colonography: is there a downward trend? *Academic radiology* 2012;19:1127-33.
 64. Buchach CM, Kim DH, Pickhardt PJ. Performing an additional decubitus series at CT colonography. *Abdominal imaging* 2011;36:538-44.
 65. McCollough CH, Bruesewitz MR, Kofler JM, Jr. CT dose reduction and dose management tools: overview of available options. *Radiographics* 2006;26:503-12.
 66. McFarland EG, Brink JA, Pilgram TK, et al. Spiral CT colonography: reader agreement and diagnostic performance with two- and three-dimensional image-display techniques. *Radiology* 2001;218:375-83.

67. Pickhardt PJ, Lee AD, McFarland EG, Taylor AJ. Linear polyp measurement at CT colonography: in vitro and in vivo comparison of two-dimensional and three-dimensional displays. *Radiology* 2005;236:872-8.
68. Pooler BD, Kim DH, Pickhardt PJ. Extracolonic Findings at Screening CT Colonography: Prevalence, Benefits, Challenges, and Opportunities. *AJR Am J Roentgenol* 2017;209:94-102.
69. American College of Radiology. ACR Practice Parameter for Communication of Diagnostic Imaging Findings. Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CommunicationDiag.pdf>. Accessed January 13, 2023.
70. Levin B, Lieberman DA, McFarland B, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. *CA Cancer J Clin* 2008;58:130-60.
71. Pickhardt PJ, Kim DH, Pooler BD, et al. Assessment of volumetric growth rates of small colorectal polyps with CT colonography: a longitudinal study of natural history. *Lancet Oncol* 2013;14:711-20.
72. Lieberman D, Moravec M, Holub J, Michaels L, Eisen G. Polyp Size and Advanced Histology in Patients Undergoing Colonoscopy Screening: Implications for CT Colonography. *Gastroenterology* 2008.
73. Kolligs FT, Crispin A, Graser A, Munte A, Mansmann U, Goke B. Risk factors for advanced neoplasia within subcentimetric polyps: implications for diagnostic imaging. *Gut* 2013;62:863-70.
74. Ponugoti PL, Cummings OW, Rex DK. Risk of cancer in small and diminutive colorectal polyps. *Dig Liver Dis* 2017;49:34-37.
75. Vleugels JLA, Hazewinkel Y, Fockens P, Dekker E. Natural history of diminutive and small colorectal polyps: a systematic literature review. *Gastrointest Endosc* 2017;85:1169-76 e1.
76. Flicker MS, Tsoukas AT, Hazra A, Dachman AH. Economic impact of extracolonic findings at computed tomographic colonography. *J Comput Assist Tomogr* 2008;32:497-503.
77. Lenhart DK, Zalis ME. Debate: diminutive polyps noted at CT colonography need not be reported. *Gastrointestinal endoscopy clinics of North America* 2010;20:227-37.
78. Kim DH, Pooler BD, Weiss JM, Pickhardt PJ. Five year colorectal cancer outcomes in a large negative CT colonography screening cohort. *European radiology* 2012;22:1488-94.
79. Hur C, Gazelle GS, Hsu EH, Halpern EF, Podolsky DK. The effect of prior colonic imaging on endoscopic productivity: potential impact of computed tomographic colonography. *Clin Gastroenterol Hepatol* 2005;3:1124-7.
80. Hixson LJ, Fennerty MB, Sampliner RE, McGee D, Garewal H. Prospective study of the frequency and size distribution of polyps missed by colonoscopy. *J Natl Cancer Inst* 1990;82:1769-72.
81. Rex DK, Cutler CS, Lemmel GT, et al. Colonoscopic miss rates of adenomas determined by back-to-back colonoscopies. *Gastroenterology* 1997;112:24-8.
82. Chin M, Mendelson R, Edwards J, Foster N, Forbes G. Computed tomographic colonography: prevalence, nature, and clinical significance of extracolonic findings in a community screening program. *The American journal of gastroenterology* 2005;100:2771-6.
83. Gluecker TM, Johnson CD, Wilson LA, et al. Extracolonic findings at CT colonography: evaluation of prevalence and cost in a screening population. *Gastroenterology* 2003;124:911-6.
84. Pickhardt PJ, Kim DH, Taylor AJ, Burnside ES. CT colonography reporting and data system (C-RADS): prospective categorization for screening in 2,501 patients. Paper presented at: 2006 RSNA Scientific Assembly, 2006.
85. Pickhardt PJ, Hanson ME, Vanness DJ, et al. Unsuspected extracolonic findings at screening CT colonography: clinical and economic impact. *Radiology* 2008;249:151-9.
86. Yee J, Kumar NN, Godara S, et al. Extracolonic abnormalities discovered incidentally at CT colonography in a male population. *Radiology* 2005;236:519-26.
87. Pickhardt PJ, Correale L, Morra L, Regge D, Hassan C. JOURNAL CLUB: Extracolonic Findings at CT Colonography: Systematic Review and Meta-Analysis. *AJR Am J Roentgenol* 2018:1-15.
88. Pooler BD, Kim DH, Pickhardt PJ. Potentially Important Extracolonic Findings at Screening CT Colonography: Incidence and Outcomes Data From a Clinical Screening Program. *AJR Am J Roentgenol* 2016;206:313-8.
89. American College of Radiology. ACR-AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment. Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/US-Equip.pdf>. Accessed January 13, 2023.

Practice 24 (Resolution 26) Technical standards are published annually with an effective date of October 1 in the year in which amended, revised or approved by the ACR Council. For practice parameters and technical standards published before 1999, the effective date was January 1 following the year in which the practice parameter or technical standard was amended, revised, or approved by the ACR Council.

Development Chronology for this Practice Parameter

2005 (Resolution 29)

Amended 2006 (Resolution 17, 35)

Revised 2009 (Resolution 36)

Revised 2014 (Resolution 2)

Revised 2019 (Resolution 3)

Revised 2024 (Resolution 26)