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## **ACR PRACTICE GUIDELINE FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) COLONOGRAPHY IN ADULTS**

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### **PREAMBLE**

These guidelines are an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the American College of Radiology cautions against the use of these guidelines 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 physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, 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 the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations on available resources, or advances in knowledge or technology subsequent to publication of the guidelines. However, a practitioner who employs an approach substantially different from these guidelines is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also 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 these guidelines 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 sole purpose of these guidelines is to assist practitioners in achieving this objective.

### **I. INTRODUCTION**

Examination of the colon by CT colonography is a useful procedure for evaluating the colon and is an evolving technology. It may be the initial method of colonic investigation or may be employed as an alternative to colonoscopy when the latter is contraindicated or imposes a significant medical risk, such as in patients on anticoagulation therapy or for whom sedation presents an increased risk. The goal of this radiologic examination is to establish the presence or absence of colorectal neoplasia by producing the optimum quality study at the minimum radiation dose necessary. This guideline is for the performance of CT colonography 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 which, with minor variations, categorize individuals into specific risk groups with correlated recommendations for management. Screening identifies individuals who are more likely to have colorectal cancer or adenomatous polyps from among those without signs or symptoms of the disease. Based on age related risk, all individuals without other

risk factors who are 50 years or older are considered at average risk. Those 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 neoplasia diagnosed at any age are defined as at increased or above average risk. Individuals with a long-standing history of inflammatory bowel disease or from families with defined genetic syndromes are at high risk. Surveillance involves the ongoing monitoring of people with previously diagnosed colorectal neoplasm or inflammatory bowel disease. The degree of risk may be related to the underlying or prior pathology. Diagnostic 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 at greater risk to harbor colorectal neoplasia.

## II. INDICATIONS

The indications for a CT colonography examination include, but are not limited to:

1. Screening examination in individuals who are at average or elevated risk for colorectal carcinoma or who have a first-degree relative with a history of colorectal neoplasm.
2. Surveillance examination in patients with a history of previous colonic neoplasm, either benign or malignant.
3. Diagnostic examination in patients with known or prior colorectal carcinoma and in symptomatic patients including, but not limited to, those with abdominal pain, diarrhea, constipation, gastrointestinal bleeding, anemia, intestinal obstruction, and weight loss.
4. Following incomplete screening, surveillance, or diagnostic colonoscopy.
5. Patients who require colonoscopy while on anticoagulant therapy.

All imaging facilities should have policies and procedures to reasonably attempt to identify pregnant patients prior to the performance of any examinations involving ionizing radiation. If the patient is known to be pregnant, the potential radiation risk to the fetus and clinical benefits of the procedure should be considered before proceeding with the study. (1995, 2005 - ACR Resolution 1a)

## III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the [ACR Practice Guideline for Performing and Interpreting Diagnostic Computed Tomography \(CT\)](#).

In addition, it is recommended that supervising and interpreting physicians should have reviewed at least 50 cases in one or more of the following formats:

1. Formal hands-on interactive training on CT colonography interpretation.
2. Supervision with a CT colonography-trained physician(s) acting as a double reader.
3. Correlation of CT colonography and endoscopy findings in patients who undergo both procedures.

Qualifications of the radiologic technologist should include familiarity with the technical requirements of CT colonography.

## 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. (2006 - ACR Resolution 35)

### A. Quality Control

The following quality controls should be applied to all CT colonography examinations:

1. Colon cleansing and distention should be adequate for detection of polyps 1 cm or larger.
2. Efforts should be made to ensure an optimal examination and to resolve questionable radiographic findings in the colon before the patient leaves the facility. Focused additional imaging of the patient should be performed as necessary.
3. The following is suggested for a quality control program:
  - a. Radiologic, endoscopic, and pathologic findings should be correlated whenever available.
  - b. Detection rates for colorectal cancer and polyps of 1 cm or greater should be determined and periodically monitored. A prevalence of 3-10% for polyps of 1 cm or

greater should be expected. There should be an assessment of false positive rates for all reported polyps.

## B. Colon Preparation

The preparation should consist of a combination of dietary restriction, hydration, osmotic laxatives such as the saline cathartics, and contact laxatives. The intent is to achieve a colon that is free of fecal material and excess fluid or as close to this ideal as possible. Polyethylene glycol lavage solution may be used, although it may leave excess residual fluid in the colon.

There is insufficient evidence to recommend the routine use of oral contrast for labeling stool and/or fluid. In addition, “prepless” or “minimal prep” approaches have not been validated in clinical trials.

## C. Examination Technique

1. An appropriate medical history should be available.
2. The patient should evacuate prior to insertion of the rectal tube.
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 employed, inflation should be discontinued if the patient complains of pain. This may indicate an increased risk of perforation.
4. An antispasmodic agent such as glucagon may be administered to relieve significant spasm or patient discomfort.
5. A sufficient volume of room air or carbon dioxide should be manually or electronically administered to provide full colon distention.
6. The adequacy of colon distention should be checked with a scout image to ensure a complete and full column of gas throughout the colon before each CT acquisition.
7. Complete anatomic imaging of the colon and rectum should be obtained in both the supine and prone positions. Additional insufflation will usually be necessary.
8. Screening studies should be performed using a low-dose, nonenhanced CT technique. Generally this requires kVp=120, and mAs  $\leq$  100. Doses as low as 10 mAs have been shown to be adequate for primary 2D interpretation, but primary 3D evaluation may require 50-100 mAs. Patients with a large body habitus or metallic implants may require a higher dose for optimal imaging. Diagnostic examinations should be performed with intravenous contrast media administration, when not contraindicated, using standard body

CT settings (kVp=120, mAs >200). Diagnostic studies are associated with an increased probability of colorectal carcinoma, which can be simultaneously staged, and an increased prevalence of extracolonic abnormalities, which can be better characterized and may represent the source of the symptom.

9. CT colonography is optimally performed on a multidetector CT (MDCT) scanner. Slice collimation of  $\leq$  3 mm with a reconstruction interval of  $\leq$  1.5 mm is optimal. The breathhold should not exceed 25 seconds. A maximum of 5 mm slice collimation with 2.5 mm reconstruction intervals is acceptable.
10. Networking capability should be available to transfer the image data to a workstation with specialized software for CT colonography interpretation.
11. The quality controls specific to the CT colonography study are:
  - a. Complete anatomic coverage of the colon and rectum.
  - b. Adequate colon distention and overall image quality. Each segment of the colon should be distended and free of most fluid and stool in at least one position. Suboptimally visualized colon should be scanned again. The use of decubitus views may be helpful in cases of suboptimal distention and excessive fluid.

## D. Data Interpretation

The purpose of CT colonography is to accurately evaluate the colon for the presence or absence of clinically significant neoplastic lesions. Abnormalities may range from discrete mucosal elevations (which may be malignant or at risk to become malignant) to infiltrating tumors. Polyps should be measured in at least two planes utilizing multiplanar reconstruction and/or 3D images, and an assessment of the size of the lesion should be made based on the largest diameter. Lesion morphology (sessile, pedunculated, flat) and segmental location should be reported.

### 1. Colon Imaging

CT data should be interpreted on a computer workstation that allows simultaneous axial imaging, multiplanar reformatted imaging, and 3D endoluminal viewing. Workstations should have the capability of displaying both axial supine and prone data together, and should allow the window width and level to be rapidly changed. Either a primary 2D interpretation technique using a cine function and scrolling through the axial images with a “colon tracking” technique or a primary 3D

endoluminal approach can be used for interpretation.

a. Primary 2D approach

Using colon tracking, the axial images are reviewed systematically at lung and soft tissue window settings using a cine function (scrolling). The colon is followed in its entirety from the ano-rectal verge to the cecum, and a search for polypoid intraluminal protrusions and assessment for abnormal wall thickness are performed.

- i. If an abnormality is suspected during the axial review, it should be interrogated with multiplanar reconstruction (MPR) and endoluminal views to evaluate the morphology of the suspected lesion.
- ii. 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 colon segment on a long mesentery.
- iii. The window setting should be adjusted to determine if the lesion shows homogeneous soft tissue attenuation or is heterogeneous.

b. Primary 3D approach

An alternative approach to data interpretation is to perform 3D endoluminal imaging. To ensure complete visualization of the colonic surface, viewing should include antegrade (cecum to rectum) and retrograde (rectum to cecum) “fly throughs” using both supine and prone acquisitions. If an abnormality with morphologic characteristics of a polyp (round, oval, or lobulated) is detected on endoluminal imaging, it should be interrogated using 2D images to determine its attenuation characteristics and apparent mobility. Not all systems software is capable of providing adequate quality reconstructions for primary 3D interpretation. A determination should be made as to whether the system being used is appropriate for this approach.

2. Extracolonic Findings

Significant visualized extracolonic abnormalities should be documented. A study optimized for evaluation of colon abnormalities may not be optimal for extracolonic abnormalities.

## V. DOCUMENTATION AND COMMUNICATION OF RESULTS

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

Any segment not adequately evaluated should be documented. All large masses and lesions that compromise luminal caliber should be communicated. Polyps  $\geq 10$  mm should be identified and described. Recommendations for endoscopic examination and their removal should be incorporated into the report.

Reporting of polyps  $\leq 5$  mm is not recommended. They are frequently non-neoplastic or, if adenomatous, have an extremely low malignant potential or probability of containing invasive cancer. Furthermore, a high percentage of polyps identified on CT colonography in this size range remain undocumented on subsequent colonoscopy, either because they represent false positive interpretations or as a result of the approximately 25% failure rate of colonoscopy to identify such lesions when present. The potential harm of colonoscopy may outweigh the benefits.

The reporting and recommendations for polyps measuring 6-9 mm may vary, depending on the certainty of the finding and clinical context. When identified with reasonable probability they should be reported. The likelihood that a polyp in this size category will progress to a clinically significant neoplasm diminishes with increasing patient age due to the low likelihood of malignant degeneration in conjunction with the long natural history of this process. In some individuals follow-up CT colonography at 3-5 years may be acceptable. Recommendations should be based upon consideration of the lesion size, diagnostic confidence, patient’s age, and existing comorbid conditions. As the polyp approximates the upper limit of this size threshold, greater emphasis may be placed upon removal if the quality of the colonic preparation is adequate. It might be more appropriate to recommend polypectomy for a high probability polyp measuring 8-9 mm in an individual  $< 70$  years of age.

Abnormalities or questionable abnormalities in structures unrelated to the colon may be identified during the process of reviewing the unenhanced 2D axial images of the colon. These are most common in, but not limited to, the kidneys, liver, adrenal glands, visualized portions of the lungs, and the major vessels. Characterization of extracolonic organs may be suboptimal with CT colonography technique. Likewise, extracolonic lesions may be present but not detectable. Most extracolonic findings are not clinically significant, and reporting may cause unnecessary patient anxiety and additional

diagnostic examinations. Clinical judgment should be used in reporting suspected extracolonic abnormalities.

## VI. EQUIPMENT SPECIFICATIONS

Optimally, examinations should be performed with MDCT equipment meeting all applicable federal and state radiation standards as well as the requirements described in Section IV.C.

Equipment should provide diagnostic image quality and networking capability. Equipment should be capable of producing kilovoltage of 120 kVp or greater and  $\leq 100$  mAs.

## VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, radiologic technologists, and all supervising physicians have a responsibility to minimize radiation dose to individual patients, to staff, and to society as a whole, while maintaining the necessary diagnostic image quality. This is the concept “As Low As Reasonably Achievable (ALARA)”.

Facilities, in consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width. The dose reduction devices that are available on imaging equipment should be active or manual techniques should be used to moderate the exposure while maintaining the necessary diagnostic image quality. Patient radiation doses should be periodically measured by a medical physicist in accordance with the appropriate ACR Technical Standard. (2006 - ACR Resolution 17)

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

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 Concerns appearing elsewhere in the ACR Practice Guidelines and Technical Standards book.

For specific issues regarding CT quality control, see the [ACR Practice Guideline for Performing and Interpreting Computed Tomography \(CT\)](#).

Equipment performance monitoring should be in accordance with the [ACR Technical Standard for Medical](#)

[Physics Performance Monitoring of Computed Tomography \(CT\) Equipment](#).

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## REFERENCES

1. Dachman AH, Glick S, Yoshida H. Computed tomography colonography and colon cancer screening. *Semin Roentgenol* 2003;38:54-64.
2. Gluecker T, Johnson CD, Wilson LA, et al. Extracolonic findings at CT colonography: evaluation of prevalence and cost in a screening population. *Gastroenterology* 2003;124:911-916.
3. 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;229:775-781.

4. Johnson CD, Harmsen WS, Wilson LA, et al. Prospective blinded evaluation of computed tomographic colonography for screen detection of colorectal polyps. *Gastroenterology* 2003;125:311-319.
5. Macari M, Bini EJ, Jacobs SL, et al. Filling defects at CT colonography: pseudo- and diminutive lesions (the good), polyps (the bad), flat lesions, masses, and carcinomas (the ugly). *Radiographics* 2003;23:1073-1091.
6. Macari M, Bini EJ, Jacobs SL, et al. Colorectal polyps and cancers in asymptomatic average-risk patients: evaluation with CT colonography. *Radiology* 2004;230:629-636.
7. 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;349:2191-2200.
8. Pickhardt PJ, Choi JR, Nugent PA, et al. Flat lesions at virtual and optical colonoscopy: prevalence, histology, and sensitivity for detection in an asymptomatic screening population. *AJR* 2004;182:74-75.
9. Taylor SA, Halligan S, Burling D, et al. CT colonography: effect of experience and training on reader performance. *Eur Radiol* 2004;14:1025-1033.
10. Yee J, Kumar NN, Hung RK, et al. Comparison of supine and prone scanning separately and in combination at CT colonography. *Radiology* 2003;226:653-661.