

Computed Tomography Colonography Pearls and Pitfalls



David H. Kim, MD^{a,*}, Courtney C. Moreno, MD^b,
Perry J. Pickhardt, MD^a

KEYWORDS

• Screening • Colorectal cancer • CT colonography • CT

KEY POINTS

- Computed tomography colonography (CTC) is an optimal test among the accepted screening options. It is highly effective like colonoscopy yet safe similar to stool tests.
- CTC is a multicomponent examination where high-quality technique in bowel preparation, colonic distention, image acquisition, and interpretation lead to accurate polyp detection.
- Contrast coating of the mucosal surface of polyps is a key phenomenon that aids in polyp detection, particularly for those of a flat morphology.
- Active infusion of carbon dioxide during image acquisition is needed to maintain good distention.
- A learning curve exists for accurate polyp detection but is easily achievable with a solid cross-sectional imaging background.

Computed tomography colonography (CTC) is a low radiation dose CT examination with a specialized protocol to optimize detection of intraluminal polyps and masses. Patients typically ingest cathartic and tagging agents in preparation for the examination. The colon is distended with continuous carbon dioxide (CO₂) infusion and the patient is scanned in multiple positions with low radiation dose technique. Images are reviewed in both two-dimensional (2D) and 3D perspectives. The use of CTC in colorectal cancer (CRC) screening has proved to be effective both in detecting the important polyp targets that develop into cancer and for detecting early cancers. Observational studies have shown that the addition of CTC to the existing options can markedly

improve CRC screening rates.^{1,2} This article serves as a practical reference to optimize CTC performance in the detection of colorectal neoplasia. A specific protocol in use in 2 clinical programs as well as defined interpretation strategies will be described. Within this framework, various clinical pearls as well as pitfalls to avoid will be a major focus of this article.

CASE FOR THE OPTIMAL SCREENING TEST

Currently, there are several screening options for CRC screening (**Table 1**). In part, this has developed because no one test is perfect, each holding certain advantages and disadvantages. For example, proponents of colonoscopy have

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^a Department of Radiology, University of Wisconsin School of Medicine and Public Health, E3/311 Clinical Science Center, 600 Highland Avenue, Madison, WI 53792-3252, USA; ^b Department of Radiology and Imaging Sciences, Emory University School of Medicine, 1365 Clifton Road, Northeast, Atlanta, GA 30322, USA

* Corresponding author.

E-mail address: dkim@uwhealth.org

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Table 1
Options for colorectal cancer screening

Screening Method	Frequency	Comments
Fecal occult blood test	Every y	Primarily detects early cancers not precancerous lesions; lowest risk profile
Fecal immunochemical test	Every y	Primarily detects early cancers not precancerous lesions; lowest risk profile
Stool DNA	Every 3 y	Primarily detects early cancers not precancerous lesions; lowest risk profile
Colonoscopy	Every 10 y	Detects precancerous lesions and cancers; risk present albeit low for perforations and sedation-related complications
Flexible sigmoidoscopy	Every 5 y	Detects precancerous lesions and cancers; only left colon examined
CTC	Every 5 y	Detects precancerous lesions and cancers; risk profile minimal

advocated for this test due to its better performance compared with stool studies. On the other hand, stool studies have been touted as the better option due to its noninvasive nature without the perforation and sedation complications that are possible at colonoscopy.

The recent inclusion of CTC to the United States Preventive Services Task Force (USPSTF) list of approved tests may change this situation over time.³ The case can be made that CTC represents the optimal test for CRC screening where the balance between test effectiveness versus test safety is best achieved by CTC. Regarding effectiveness, CTC is similar to colonoscopy where it can detect both benign polyp precursors that may develop into cancer in the future as well as early CRC. The sensitivity and specificity for large polyps (≥ 10 mm) ranges between 90% to 94% and 86% to 96%, respectively.^{4,5} For cancer detection, CTC has a sensitivity of 96.1%.⁶ In contrast, although stool studies can detect early cancers, the sensitivity for large polyps/advanced adenomas by fecal occult blood test (FOBT)/fecal immunochemical test (FIT) is poor at 22% to 40%.⁷ This is not surprising because polyps do not typically bleed. Likewise, stool DNA tests have similar poor sensitivity at 42%.⁸ There is little doubt that the ability to detect these precursor lesions markedly leverages CTC effectiveness over those tests that can only detect early cancers (ie, FOBT/FIT).

CTC has an excellent safety profile, closer to stool tests than that of colonoscopy. The low-pressure insufflation used for CTC carries a very low risk for perforation. Whereas rates for perforation at colonoscopy are at about 1 per thousand procedures, the rate at CTC is near nonexistent at 0.04% for screening patients.⁹ Furthermore, CTC does not require sedation like colonoscopy, obviating the potential complications related to

anesthetic medications. There have been initial theoretic concerns regarding future cancer induction from radiation, but similar dose exposures in other populations strongly suggest that clinically significant risk likely does not exist.^{10–12} The Health Physics society argues against estimating health risks for exposure similar or below background levels (which would include levels for CTC screening) because the statistical uncertainties at these low levels are great.¹³ For these reasons, a case can be made that CTC represents the optimal test within the menu of options for CRC screening.

THE TECHNICAL ASPECTS OF THE COMPUTED TOMOGRAPHY COLONOGRAPHY EXAMINATION

CTC is a multicomponent examination that includes specific patient activities before actual scanning is undertaken. The examination can be divided into bowel preparation, colonic distention, and image acquisition. There are numerous protocols in current use in undertaking CTC, each with advantages and various trade-offs. The specific protocol described in the following paragraphs has been validated in 2 large-scale clinical programs ($n > 16,000$ patients). The protocol is optimized for average risk CRC screening in the healthy asymptomatic individual. With this framework in place, clinical observations and specific pitfalls to avoid gained from daily clinical use will be discussed to help shorten the CTC learning curve for optimal polyp detection.

Bowel Preparation

The bowel preparation begins 1 day before the scheduled examination (Table 2). The purpose is two-fold: (1) to clear the colon of any bulk material

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