Radiology

REVIEWS AND COMMENTARY • STATEMENTS AND GUIDELINES

CT Colonography Reporting and Data System (C-RADS): Version 2023 Update

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Conflicts of interest are listed at the end of this article.

See also the editorial by Taylor in this issue.

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The CT Colonography Reporting and Data System (C-RADS) has withstood the test of time and proven to be a robust classification scheme for CT colonography (CTC) findings. C-RADS version 2023 represents an update on the scheme used for colorectal and extracolonic findings at CTC. The update provides useful insights gained since the implementation of the original system in 2005. Increased experience has demonstrated confusion on how to classify the mass-like appearance of the colon consisting of soft tissue attenuation that occurs in segments with acute or chronic diverticulitis. Therefore, the update introduces a new subcategory, C2b, specifically for mass-like diverticular strictures, which are likely benign. Additionally, the update simplifies extracolonic classification by combining E1 and E2 categories into an updated extracolonic category of E1/E2 since, irrespective of whether a finding is considered a normal variant (category E1) or an otherwise clinically unimportant finding (category E2), no additional follow-up is required. This simplifies and streamlines the classification into one category, which results in the same management recommendation.

Supplemental material is available for this article.

An earlier incorrect version of this article appeared online. This article was corrected on January 30, 2024.

The American College of Radiology (ACR) reporting and data systems continue to expand and evolve with numerous classifications for various organs and anatomic regions. The overarching goals of all the reporting and data system classifications are similar and include the development of standardized terminology and report structure. Standardization allows for more consistent and reliable communication of findings. These findings then form the basis of recommendations for patient treatment and follow-up. Additionally, reporting and data systems enable uniform classification of data for use in research studies and facilitate the assessment of quality metrics and patient outcomes.

The CT Colonography Reporting and Data System (C-RADS) is one of the oldest classifications and has become widely used since its introduction in 2005 (1). The original system includes criteria for the evaluation of both colorectal lesions (categories C0–C4) and extracolonic findings (categories E0–E4). Descriptors of colorectal polyps and masses include lesion attenuation, morphologic characteristics, size, and location. Each category of colorectal findings and extracolonic findings is associated with a linked recommendation applicable to both screening and diagnostic CT colonography (CTC).

Overall, increased experience with the use of C-RADS demonstrates its proven utility, which has helped achieve the stated goals of reporting and data system classifications (2). However, as more centers have implemented C-RADS, specific areas require clarification. Thus, herein we present C-RADS version 2023, which introduces several important updates.

First, there is specific updated guidance for the classification of colonic mass-like diverticular strictures that are likely benign in a new subcategory C2b. Second, an updated approach to extracolonic lesions merges the E1 and E2 categories into E1/E2 for consolidated management. This simplifies extracolonic classification of incidental findings where no additional follow-up is required. Finally, the E3 category remains for likely clinically unimportant findings that may warrant further workup and E4 remains for findings that are likely clinically important. Studies have shown that less than 10% of screening CTC examinations have E3 findings and that more than 90% of these findings are clinically insignificant (3–5), whereas E4 findings require additional evaluation and close surveillance or treatment (6).

Origin and Development of C-RADS

The original Working Group on Virtual Colonoscopy first met in 2003 at the fourth International Virtual Colonoscopy Symposium in Boston, Mass. They represented an ad hoc group of radiologists active in clinical and/or research CTC. The group included members of the ACR Colon Cancer Committee. Once the group reached a consensus

Abbreviations

ACR = American College of Radiology, C-RADS = CT Colonography Reporting and Data System, CTC = CT colonography, 3D = three-dimensional, 2D = two-dimensional

Summary

CT Colonography Reporting and Data System version 2023 introduces a new subcategory, C2b, for likely benign mass-like diverticular strictures and merges categories E1 and E2 for extracolonic findings not requiring follow-up.

Essentials

- CT Colonography Reporting and Data System (C-RADS) version 2023 updates the classification and management of CT colonography examinations 18 years after the initial proposal of C-RADS.
- Category C2 is now subcategory C2a, and a new subcategory, C2b, is introduced for mass-like diverticular strictures that are likely benign.
- Extracolonic classification is simplified by merging categories E1 and E2 into a common E1/E2 management recommendation signifying no extracolonic findings requiring follow-up.

on the major discussion points, they circulated a questionnaire for review, followed by a draft C-RADS proposal. This proposal underwent multiple additional rounds of commentary and consensus-building via email and teleconferences before final endorsement at the fifth International Symposium in 2004 and publication in *Radiology* in 2005 (1). After 12 years and increasing adoption of C-RADS, a formal committee was formed in 2017 to review the clinical experience and to incorporate C-RADS under the ACR reporting and data system structure. The ACR C-RADS Committee membership included a small subset of volunteer experts from the ACR Colon Cancer Committee. In developing C-RADS version 2023, the group raised discussion points, developed three iterative online surveys and distributed them using SurveyMonkey (Momentive.ai; see Appendix S1), conducted multiple teleconferences, and circulated a draft proposal multiple times for consensus building. In addition, the group conducted a thorough literature search in the Ovid MEDLINE database using ACR's Guidelines & Recommendations–Authoring, Validation, & IT Access System (GRAVITAS) (7) and keywords provided by the ACR C-RADS committee. Inclusion and exclusion criteria were used to capture the relevant literature from January 2005 to January 2021. Defined keyword searches yielded 1028 references for member review (Appendix S2). Input from international CTC experts from the United Kingdom, Italy, and Korea was also solicited.

Reporting: Descriptive Features of Colonic Polyps at CTC

A polyp is defined as a homogeneous soft tissue attenuation lesion that arises from the colonic mucosa, demonstrating a fixed point of attachment to the bowel wall, and projects into the colonic lumen. Polyps reported at CTC are typically 6 mm or larger without a specific upper size limit. Masses, including laterally spreading tumors measuring at least 30 mm, are excluded from the definition of polyps and should be described and reported separately (Table 1).

Table 1: Description of Colonic Lesions at CTC

Feature	Description
Attenuation	Soft tissue attenuation
	Fat—lipoma, fibrolipoma, or inverted diverticulum (classified as C1)
Morphology	Sessile—broad-based
	Pedunculated—polyp with separate stalk
	Flat or laterally spreading tumors
	Mass (≥30 mm)
Size	Large (≥10 mm)
	Small (6–9 mm)
	Diminutive (≤5 mm)—not typically reported
Location	Six standardized colonic segments: rectum, sigmoid colon, descending colon, transverse colon, ascending colon, and cecum

CT Attenuation of Polyps

The soft tissue nature of a polyp should be confirmed by using the interactive window and level adjustments at two-dimensional (2D) CTC. Polyps surrounded by very-high-attenuation material may appear either higher or lower attenuation relative to soft tissue, phenomena called pseudo-enhancement and beam-hardening, respectively (8). Contrast material can be seen on the surface of polyps. This is thought to be due to adherence of the tagging agent to mucin produced by the polyp (9). The presence of macroscopic fat indicates a lipoma, fibrolipoma, or an inverted diverticulum, all of which are benign findings that do not require colonoscopy. Foci of air or tagging agent within a lesion are consistent with retained fecal matter. Fecal matter may or may not shift to the dependent surface. Color maps applied on the endoluminal view can be helpful in showing the CT attenuation of soft tissue, tagging agent, or fat; however, the 2D views are definitive.

Size

The risk of a polyp containing or developing into a malignancy is primarily dependent on its size. The ACR Practice Parameter suggests using a threshold of 6 mm for reporting polyps at CTC and includes technical suggestions to help ensure accurate measurements (10). Lesions less than or equal to 5 mm (diminutive) are much more likely to be hyperplastic polyps or benign tubular adenomas at histologic analysis or to represent adherent stool. Thus, relevant polyps should be stratified as small (6–9 mm) or large (10 mm or larger). Hyperplastic polyps are a type of colonic polyp that have a serrated morphology but lack dysplastic architectural distortion and do not carry risk for transformation to carcinoma (11). Tubular adenomas are the most common type of adenomatous colonic polyp and are formed by glandular tissue. Although tubular adenomas are predominantly benign, they are typically considered to have malignant potential (12).

Polyps should be measured using the single largest dimension; simple axial measurements alone may be inadequate. The diameter of a polyp may be measured manually or by using

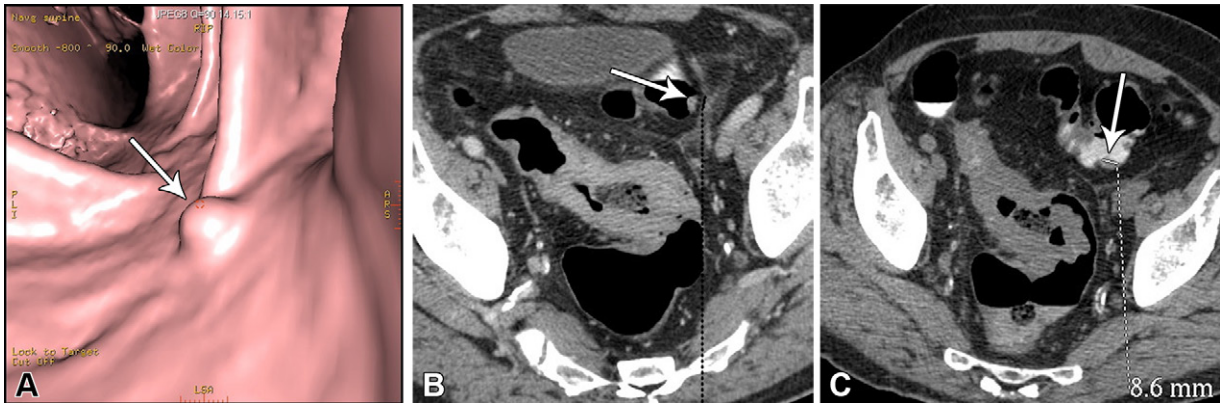

Figure 1: Sessile polyp. A 77-year-old male patient presented for CT colonography following an incomplete colonoscopy for an obstructing sigmoid colonic mass. An 8-mm sessile polyp (arrow) is identified in the proximal sigmoid colon on the **(A)** three-dimensional endoluminal view, **(B)** axial prone view, and **(C)** axial supine view. Note that the polyp has a broad base without a neck or stalk. A tubular adenoma was diagnosed at colectomy.

automated polyp measurement software. Pedunculated polyps should be measured using the largest dimension of the head of the polyp exclusive of the stalk. It is optional to provide bidimensional measurement or volume of the polyp. It is also optional but helpful to describe the stalk of a pedunculated polyp as long and thin versus short and thick. The three-dimensional (3D) endoluminal view optimizes the best viewing angle to obtain the single largest dimension measurement except when there is a coating of contrast material. When using a 2D view, use a CTC setting (eg, window width of 1500–2000 HU and window level of −200 to 0 HU). Standard axial or multiplanar reconstructions are ordinarily used, but some readers prefer optimized oblique 2D views to find the largest polyp dimension. Interactive window width and window level adjustment is important when measuring flat lesions on 2D views. Tagging agent adherent to the lesion surface should not be included in the measurement.

It is helpful to report how a polyp measurement was obtained at CTC (eg, 3D, standard 2D, or optimized oblique 2D view) and to note a series and section position or to save an annotated 2D image in case polypectomy is not performed. This aids in accurate size comparison at interval follow-up CTC.

Visualization Specifications and Recommendations

The interpretation of CTC images requires interactive use of both 2D and 3D data sets to optimize polyp detection (13,14). A set of baseline tools to promote viewing in either environment is needed as well as the ability to seamlessly shift from the same point from one perspective to the other.

Two-dimensional imaging consists of stacked transverse CT images where the colon is traced along the entirety of its length with interactive scrolling. Basic picture archive and communication system functionality is required. This includes the ability to zoom and pan, adjust window width and level, and switch between orthogonal planes (ie, sagittal and coronal). There should be the ability to correlate a specific location between the orthogonal planes. The preferred window width and level setting (ie, polyp window) is 1500–2000 HU and −200 to 0 HU, respectively, from long-standing clinical experience based off similar settings seen in a porcine model (15). This wide window centered around water attenuation allows excellent contrast between the soft tissue polyp and the gas-filled lumen and between the polyp and any adherent contrast material or contrast fluid pools. At the same time, this window and level setting allows differentiation between soft tissue and fat attenuation. In combination with 3D measurements, it also correlates best with the measurement made at optical colonoscopy (see the section on measurement below) (16). Standard soft tissue windows (400 HU width, 30 HU level) are useful to further accentuate soft tissue attenuation for polyp evaluation but should not be used primarily for polyp detection as polyps can be obscured with this setting.

Three-dimensional imaging can employ different formats, including endoluminal perspective with active flythrough, anatomic dissection views, perspective filet, and unfolded cube. The endoluminal perspective with a 120° field of view flythrough is the standard format with the largest published experience (17,18). Although increasing the field of view beyond 120° increases mucosal coverage and decreases interpretation time, increased image distortion can decrease polyp conspicuity and may have a negative impact on detection (19). Evaluation involves an interactive navigation through the length of the colon in both a retrograde and antegrade fashion. The other formats listed are acceptable but with less published experience (20–24). These alternatives have been shown to decrease the time of interpretation where more of the colonic mucosal surface can be viewed from a given vantage point but at the expense of increased distortion (25).

Morphologic Features

Polyps can be categorized as sessile, pedunculated, or flat. Sessile lesions are broad-based lesions (Fig 1), whereas pedunculated polyps have a visible stalk (Fig 2). Lesions that are flat or plaque-like in morphology and typically measure less than 3 mm in vertical elevation are categorized as "non-polypoid lesions" (Fig 3). This category can also include plaque-like lesions, which are laterally spreading tumors and were previously known as carpet lesions, whose maximal vertical height may

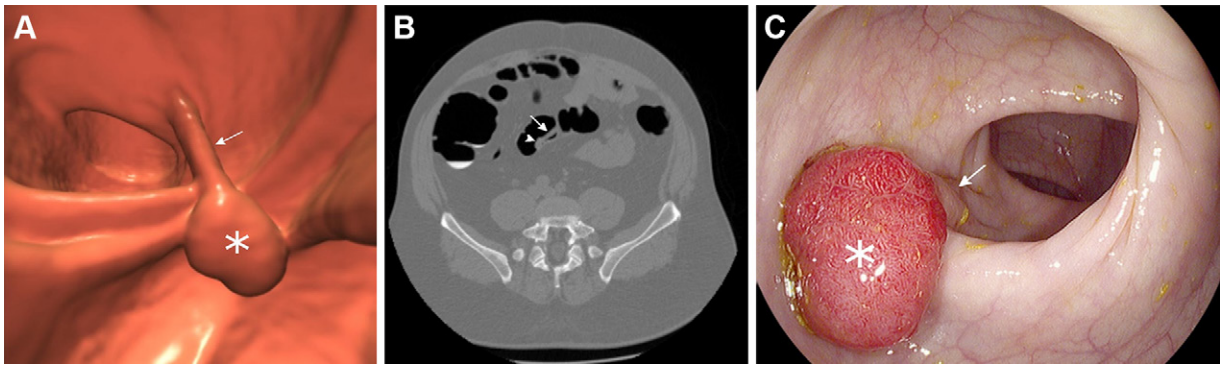

Figure 2: Pedunculated polyp. A 52-year-old male patient who underwent screening CT colonography was shown to have a pedunculated polyp with the polyp head (* in **A** and **C**; arrowhead in **B**) on the **(A)** three-dimensional endoluminal view and **(B)** axial supine view on a long stalk (arrow in **A–C**) in the sigmoid colon. This was determined to be a tubulovillous adenoma at polypectomy. **(C)** Photograph from colonoscopy.

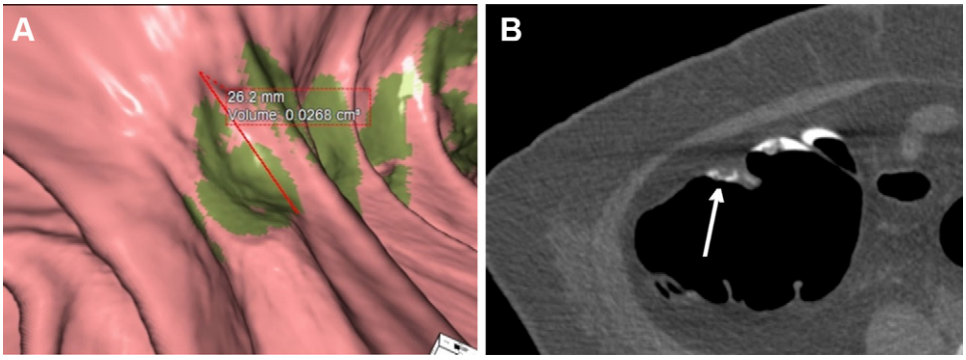

Figure 3: Flat lesion. A 70-year-old male patient who underwent diagnostic CT colonography for anemia was found to have a flat lesion (arrow in **B**) coated with iodinated contrast material along a haustral fold in the ascending colon on **(A)** three-dimensional endoluminal view and **(B)** axial prone view. This was determined to be a tubular adenoma at polypectomy.

exceed 3 mm and are most commonly seen in the rectum and right colon (Fig 4) (26,27).

Data show that sessile serrated lesions are more likely to be nonpolypoid and sometimes challenging to detect at CTC. Up to 85% of these lesions may be coated with contrast material, which helps highlight these lesions for improved detection. This may possibly be due to their "mucus cap," which is a feature also visible at colonoscopy (28,29).

Specifying Location of Lesions and Relevant Anatomy

The use of CTC is highly accurate in defining the anatomic location of polyps and masses because these determinations derive from the fixed framework afforded by CT scanning (30). Lesion location should be described in terms of six segments of the colon: rectum, sigmoid colon, descending colon, transverse colon, ascending colon, and cecum (31). Providing a description of lesion location as being within the proximal (closer to the cecum), mid, or distal (closer to the anus) aspect of a segment is helpful for follow-up management of lesions. We do not recommend using the term "flexure" as a location descriptor (31). Correlating the location of lesions between CTC and conventional colonoscopy remains problematic because the endoscopist has few fixed reference points for determining position in the colon (32,33).

A centerline distance from the anal verge to the lesion can be computed from the 3D model at CTC. However, these measurements, while accurate, do not correlate exactly with colonoscopy measurements. Colonoscopy measurements are up to half of the true centerline CTC distance measurement due to telescoping and pleating of the colon over the scope. Thus, it is recommended to not report CTC distances (and instead use the segmental location descriptors) to avoid confusion and an apparent discordance between findings made at CTC and optical colonoscopy (33).

Pitfalls of Lesion Measurement

The risk stratification and management of lesions identified at screening CTC is determined primarily by lesion size (28,34–36), although the morphologic features of the lesion can help further substratify risk. A linear measurement of a lesion's largest diameter as visualized with polyp windows using electronic calipers is typically obtained (37). However, flat lesions with an adherent contrast material cap should be viewed using varying window levels and widths to exclude the surface contrast material coating from measurement. Additionally, if a lesion is irregular in shape or its largest diameter is not aligned with one of the three orthogonal imaging planes, measurements should be obtained on the 3D endoluminal view as it is possible to underestimate lesion size using a 2D technique. Due to the projection of 3D surfaces onto 2D displays, it is easy to overestimate lesion size by inadvertently placing a caliper end point on a far-distant portion of the colon. Both 2D and 3D measurement schemes are acceptable for measuring lesions after evaluating for pitfalls; however, 2D measurements typically tend to underestimate the true size of polyps compared with 3D measurements by approximately 1 mm (31,37).

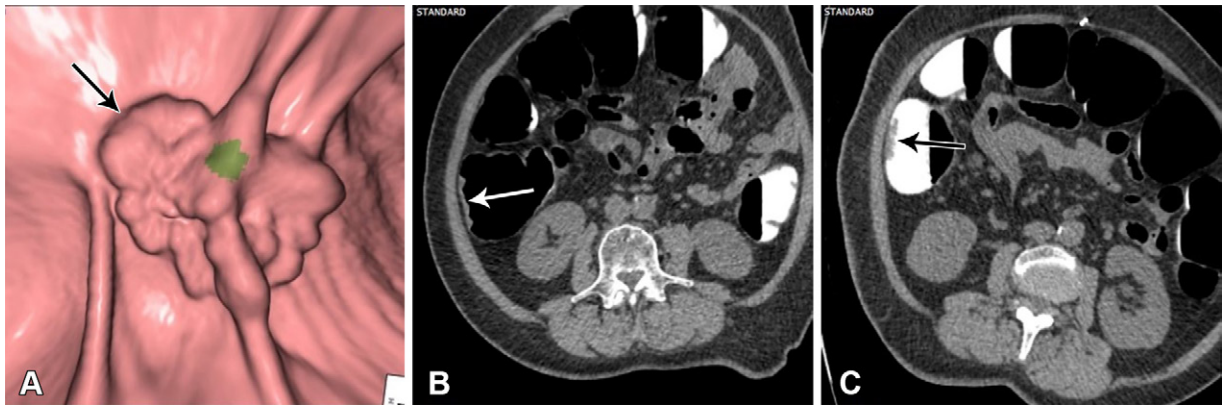

Figure 4: Carpet lesion. A 69-year-old female patient who underwent CT colonography for colorectal cancer screening was found to have a 3.7-cm carpet lesion in the ascending colon (arrow) on **(A)** three-dimensional endoluminal view, **(B)** left lateral decubitus view, and **(C)** right lateral decubitus view. This was determined to be a tubulovillous adenoma at polypectomy.

Some commercial CTC workstations offer automated estimation of polyp volume. This technique has been studied in a limited fashion, demonstrating acceptable performance (38–40). The potential advantages of automated volume measurements include increased sensitivity to changes in polyp size (important for follow-up of lesions) and the potential to reduce human error in measurement (41). However, the available, typically semiautomated, volumetric measurement systems are proprietary and performance differences between these systems have not, to our knowledge, been compared. In addition, no other colon screening specialists use volume measurements to characterize polyps. Finally, visualization techniques that involve unfolding of the colon, presenting a planar view of the endoluminal surface similar to a pathology specimen, may cause distortion and alter polyp sizes.

Classification and Suggested Follow-up of Colonic Lesions

Definition of the Target Lesion

There is general consensus that advanced neoplasia is the primary target for colorectal cancer prevention. Advanced neoplasia is defined by size and/or histologic criteria. This includes any colorectal polyp measuring at least 10 mm in diameter, any adenoma demonstrating high-grade dysplasia or clinically significant components of villous histologic characteristics, serrated polyps with dysplasia, or invasive cancer. Because CTC cannot directly determine histologic characteristics, management decisions for polyps identified at CTC are based on the prevalence of advanced histologic features observed among resected polyps at different size thresholds.

The rates of advanced adenomas in different size categories have been well described (42–46). In a screening cohort of 13 992 patients, the proportion of advanced adenomas (including serrated lesions) was 1.7% in polyps measuring 5 mm or smaller and 6.6% in polyps 6–9 mm, compared with 30.6% in polyps measuring at least 10 mm; the risk of cancers in these three size ranges is 0%, 0.2%, and 2.6%, respectively (42). In a study of 32 790 colonoscopy examinations yielding 23 524 conventional adenomas, advanced adenomas were seen in 2.1% of adenomatous polyps 5 mm or smaller and 5.6% of polyps measuring 6–9 mm, with no subcentimeter cancers found among more than 40 000 total polyps smaller than 10 mm (43). The authors concluded that results support both the practice of resecting and discarding small polyps at colonoscopy and the current CTC recommendations to not report diminutive polyps 5 mm or smaller.

Diminutive polyps (≤5 mm).—Based on the low risk that diminutive polyps will harbor clinically significant neoplasia, CT colonography guidelines do not mandate reporting of polyps 5 mm or less in size. Moreover, nonreporting of diminutive polyps has also been found to be cost-effective and safe (47,48).

Small polyps (6–9 mm).—Concordant with the ACR Practice Parameters (10), multidisciplinary guidelines from the American Cancer Society in 2008 (49) and 2018 (50), and the U.S. MultiSociety Task Force on Colorectal Cancer in 2017 (51), polyps 6 mm and larger are reported at CTC. For patients who can undergo colonoscopy, polypectomy may be offered. In other patients with one or two small polyps, follow-up at 3 years may be considered depending on age or comorbidity (51).

Large polyps (10 mm or larger).—Patients with lesions 10 mm or larger should be referred to colonoscopy for polypectomy. At this size, the proportion of advanced adenomas is 30.6%, with polyps of adenomatous histologic features having increased rates of high-grade dysplasia (5%–10%) and carcinoma (1%–3%) (28,42,52–54). Polyps of this size with flat morphologic features often represent sessile serrated lesions, which are precursor targets with future malignant potential considered separate from conventional adenomas. Sessile serrated lesions are often proximal in colonic location and larger than 10 mm, and, owing to their flat morphologic features, are more difficult to detect with both CTC and optical colonoscopy. However, sessile serrated lesions may be rendered more conspicuous at CTC when using a combined barium and iodine tagging regimen because the contrast material tends to adhere to their surface (9,28,55,56).

Subepithelial lesions arise from deep within the gastrointestinal mucosa, typically within the submucosa or muscularis propria, and have a smoother contour than other polyps

and masses with an intact overlying mucosa. Because of the subepithelial location of these lesions, endoscopic biopsies may be nondiagnostic. While some histologies such as lipomas may be more readily diagnosed with CT, others, such as gastrointestinal stromal tumors, leiomyomas, neurogenic tumors, and lymphovascular tumors, may require endoscopic US and endoscopic US–guided biopsies for sufficient histologic characterization (57).

Colonic masses.—Colonic masses are defined as soft tissue lesions measuring at least 3 cm. The sensitivity and specificity of CTC for colonic masses approaches 100% (58,59). CTC has also been shown to be accurate for colon cancer staging when using intravenous contrast material (60–64). Patients with masses identified at CTC may be referred to colonoscopy or directly to surgery and/or oncology given the excellent performance of CTC in detecting masses, especially those with annular constricting morphologic features.

Interval between screening examinations.—The American Cancer Society (50) and the United States Preventative Services Task Force (65) suggest screening intervals for CT colonography of 5 years. In multiple large CTC trials using the most current techniques (fecal and/or fluid tagging, multidetector CT scanners), a 5-year interval shows comparable performance with colonoscopy, with a low rate of interval development of cancer or high-grade dysplasia (17,18,66–68). In a single institution study of 5640 negative CTC studies, positive rates of large polyps, advanced neoplasia, and cancer at 5-year follow-up CTC for 1429 returning patients were significantly less or comparable to those at original screening (namely, 3.8%, 2.8%, and 0.14% vs 5.2%, 3.2%, and 0.45%, respectively) (17). After successive negative 5-year CTC examination, some sites may extend the screening interval up to 10 years (68). The success of screening is dependent on adherence to programmatic screening at regular intervals to detect the small number of indolent polyps that may increase in size.

Classification of Colonic Lesions

In addition to a description of the size, location, and morphologic characteristics of a colonic lesion, the CTC report should also include an overall description of the large intestine (tortuosity, redundancy, diverticulosis) and evaluation of examination quality (adequacy of cleansing, distention, and tagging). In select circumstances, the report may also include a measure of reader confidence (low, moderate, high), particularly in the case of uncertain confidence in a finding or a categorization of C2a or C2b (Table 2).

Category C0

This category is reserved for an examination in which a confident interpretation of the colonic findings is not possible due to technical limitations or a lack of results from prior studies necessary for comparison. Technical limitations may include an inability to exclude the presence of polyps 10 mm or larger due to the complete collapse of a colonic segment or subsegment, insufficient bowel insufflation, or inadequate bowel cleansing—all factors that severely limit the performance of CTC. If a segment such as the sigmoid colon appears underdistended and possibly mass-like due to a likely benign etiology (eg, myochosis coli in the setting of chronic diverticular disease), subcategory C2b should be used instead. Myochosis coli describes the wall thickening and shortening of the colon due to diverticulosis and is due to the shortening of the taeniae coli and the thickening of the circular muscular layer (69). The C0 category may also be used when a prior examination is not available for comparison to document the stability of a colonic finding. This category would change once the prior examination becomes available for comparison and a subsequent report addendum is provided.

Therefore, for category C0 lesions, C-RADS version 2023 recommends repeat examination if there is inadequate visualization, consideration of an alternative screening test, or amendment of the findings when prior studies become available.

Category C1

This category indicates the absence of colorectal abnormalities that would increase the patient's risk of developing colorectal carcinoma in the context of regular screenings. This would include a normal colon or only diminutive lesions, as well as benign findings such as diverticula, myochosis coli, muscular hypertrophy (when there is high confidence of benignity), and lipomas. To qualify for this category, the entire colon must be adequately cleansed and distended with no polyps present measuring 6 mm or larger. This category may include patients with diminutive, nonreportable polyps (5 mm or smaller), which are findings of limited specificity that will nevertheless be re-evaluated during the course of a 5-year screening interval, as well as findings that can be confidently characterized as residual fecal material.

For category C1 lesions, C-RADS version 2023 recommends continuing routine screening every 5–10 years unless readers of the CTC scans choose to shorten the screening interval at his or her own discretion in the setting of extensive diverticulosis, incidental inflammatory changes, and so on.

Subcategory C2a (Previously Category C2)

Subcategory C2a represents examinations with one or two colonic polyps measuring 6–9 mm. In this subcategory, depending on local practice patterns and referrer preference, the risks of polypectomy may outweigh the benefits of resecting polyps of questionable clinical significance. In prior series, most polyps of this size were stable or regressed and/or resolved, with only 22%–35% progressing within 3 years (41,66); these results are similar to those of prior colonoscopy studies (70). About 10%–14% of polyps even showed complete resolution. Management options include optional colonoscopy for polypectomy or a repeat CTC in 3 years to re-evaluate growth (18,41,44,66). Readers of CTC scans should consider adding a measure of reader confidence in the finding of these subcentimeter polyps (low, moderate, or high). If a lesion is not sufficiently or confidently characterized (low confidence), the follow-up interval may be shortened (to increase confidence in a reproducible positive finding and to evaluate stability).

Table 2: C-RADS Version 2023 Assessment Categories for Colonic Findings

C-RADS Colonic Findings Score	Definition	Management
C0	Inadequate study and/or awaiting prior comparisons: Inadequate preparation: cannot exclude lesions ≥10 mm owing to presence of fluid and/or feces Inadequate insufflation: one or more colonic segments collapsed on both views (except in suspected myochosis coli—see C2b)	Awaiting prior comparisons. Amend when prior studies are available. Repeat CTC or consider an alternative screening test if inadequate.
C1	Normal colon or benign lesion: No visible abnormalities of the colon No polyp ≥6 mm Lipoma or inverted diverticulum Nonneoplastic findings—eg, colonic diverticula, asymptomatic pneumatosis cystoides coli	Continue routine screening*
C2a	Intermediate polyp or indeterminate finding: Intermediate polyp 6–9 mm, fewer than three in number	Repeat CTC in 3 y or colonoscopy referral recommended†
C2b	Likely benign diverticular finding: Mass-like area such as severe diverticular myochosis coli, muscular hypertrophy, or stricture	Likely benign: recommend repeat CTC in 5 y Uncertain benign: recommend repeat CTC in ≤3 y
C3	Polyp, possibly advanced adenoma: Polyp(s) or subepithelial lesion ≥10 mm Three or more polyps, each 6–9 mm Polyps previously categorized as C2a that have enlarged in size at follow-up	Colonoscopy referral recommended‡
C4	Likely malignant colonic mass: Polypoid mass ≥30 mm or a malignant-appearing mass Lesion compromises bowel lumen or demonstrates extracolonic invasion	Colonoscopy, surgical and/or oncologic consultation recommended‡

Note.—Adapted, with permission, from reference 1. C-RADS = CT Colonography Reporting and Data System, CTC = CT colonography.

* Every 5–10 years.

† For polyps 6 mm and greater, recommend polypectomy in suitable patients versus follow-up study in 3 years, subject to individual patient circumstance.

‡ Communicate to referring physician as per accepted guidelines for communication, such as American College of Radiology Practice Parameter for Communication of Diagnostic Imaging Findings (85). Subject to local practice, endoscopic biopsy may be indicated.

For subcategory C2a lesions, C-RADS version 2023 recommends repeat examination in 3 years to evaluate for growth versus referral to colonoscopy depending on patient age, comorbidities, preference, and local patterns of practice. If unequivocal growth is demonstrated at the 3-year follow-up examination, then the examination would be categorized as C3 and colonoscopic polypectomy is recommended.

Subcategory C2b

Subcategory C2b is a new class for cases in which a soft tissue mass or mass-like area is likely benign, such as moderate to severe diverticular myochosis coli, muscular hypertrophy, or stricture where malignancy cannot be entirely excluded. Typical findings of a C2b lesion include an area of luminal narrowing and concentric wall thickening where haustral architecture is preserved and no mucosal irregularities are seen on 3D views (Figs 5, 6). The presence of diverticulosis and lack of overhanging edges or shoulders can also suggest benignity (69). A review of prior studies can be very helpful when available.

For subcategory C2b lesions, C-RADS version 2023 recommends management dependent on the clinical context and level of concern. If there is a high likelihood of a benign lesion, then routine follow-up CTC may be suggested at a 5-year interval. If benignity is less certain, depending on the specific clinical context, follow-up CTC at a shortened interval of 3 years or less may be performed. Alternatively, if the clinical index of concern is high, the lesion should be classified as C4, with a recommendation for flexible sigmoidoscopy or colonoscopy.

Category C3

Category C3 is used for the finding of one or more polyps measuring 10 mm or larger or for three or more polyps measuring 6–9 mm. Polyps measuring 1 cm or larger have a 10%–25% likelihood of high-grade dysplasia or carcinoma, with risk directly related to size. The presence of three or more synchronous 6–9-mm polyps also increases the risk of developing advanced adenomas (71,72). Polyps showing interval growth at follow-up after a previous C2a categorization should also be included in this category. Subepithelial lesions, which may be suspected once they reach a size of at least 1 cm, are also included in this category and may be further evaluated with endoscopic US (58). As it is difficult to determine if a lesion is subepithelial when smaller than 1 cm, these lesions can be managed in a manner similar to that of polyps of equivalent size (category C2a).

For category C3 lesions, C-RADS version 2023 recommends colonoscopic polypectomy. If a polypectomy cannot be

performed (in the setting of distal colonic narrowing or severe colonic tortuosity), short-interval follow-up CTC within 1 year or referral to surgery may be appropriate depending on patient age and comorbidities.

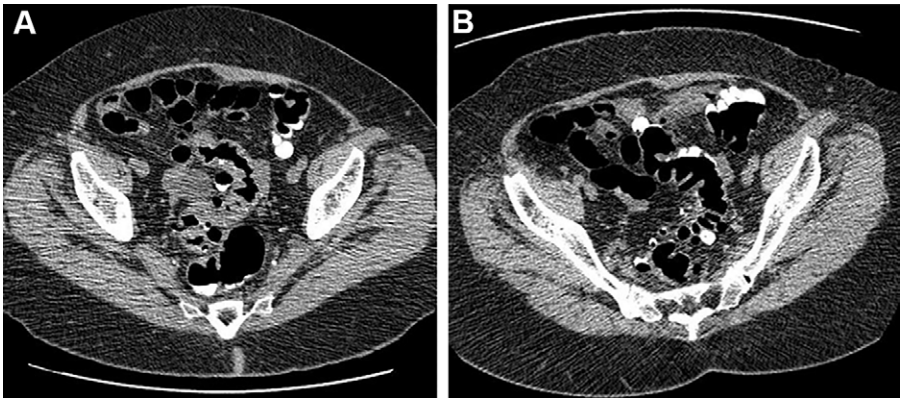

Figure 5: Subcategory C2b lesions: sigmoid diverticular myochosis. An 81-year-old female patient who underwent screening CT colonography was shown to have a segment of sigmoid colon with circumferential wall thickening on the **(A)** two-dimensional (2D) supine view, but with better distention there was preservation of haustral architecture without focal mucosal irregularity on the **(B)** 2D prone view.

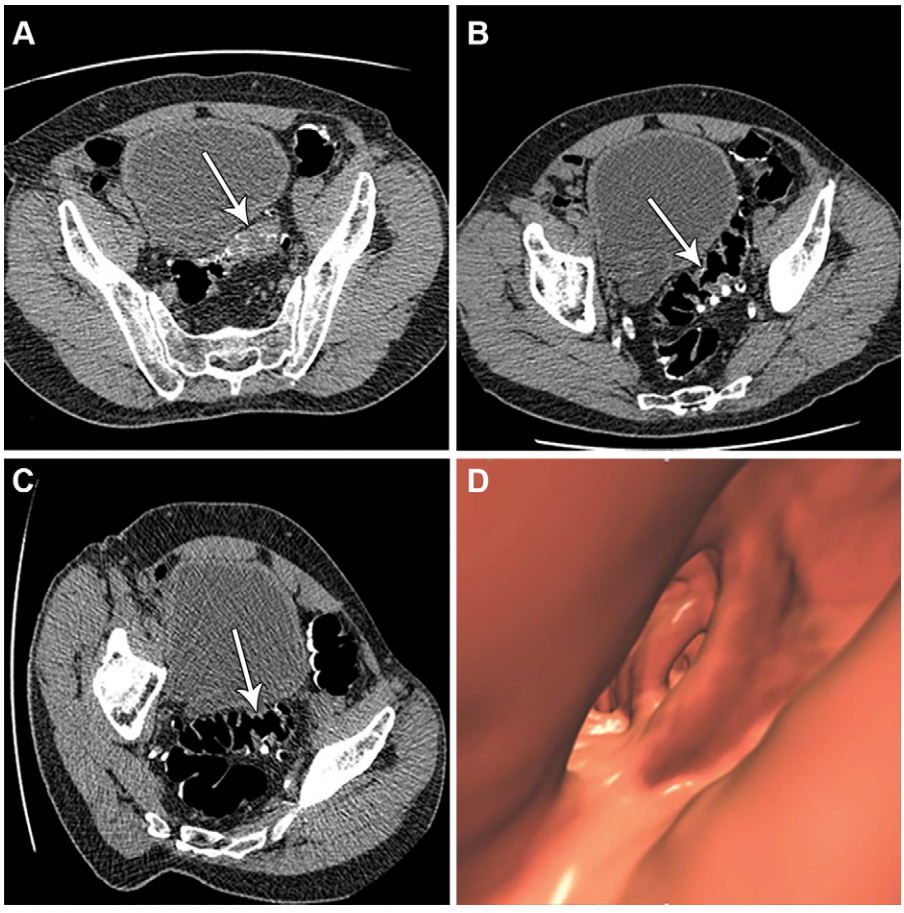

Figure 6: Subcategory C2b lesion: sigmoid diverticular myochosis. A 72-year-old male patient on warfarin for colorectal cancer screening who underwent CT colonography. Note under-distention and wall thickening in the region of sigmoid diverticulosis (arrow in **A–C**), which is more severe on the **(A)** prone view but improved on the **(B)** supine view and **(C)** additional right lateral decubitus view. Note the preserved haustral architecture without mucosal irregularity on the **(D)** three-dimensional image and the change in wall thickness between positions. Colonoscopy performed 5 years later as part of adenoma surveillance showed only diverticula in the sigmoid colon (not shown).

Category C4

This category should be used for the finding of a polypoid mass measuring 30 mm or greater or a malignant-appearing mass. CTC has high sensitivity and specificity in the detection of colon cancer. CTC can also enable simultaneous staging for T3 or T4 disease (when intravenous contrast material is used) as well as evaluation for the presence of lymphadenopathy, metastasis, and synchronous colonic lesions (58,60,73).

For category C4 lesions, C-RADS version 2023 recommends surgical and/or oncologic consultation with or without preoperative colonoscopic biopsy.

Reporting of Extracolonic Findings

Introduction and Rationale

The purpose of screening CTC is to identify malignant and premalignant lesions within the colon of an otherwise asymptomatic individual. Therefore, any findings outside of the colon are considered incidental. Incidental findings at CT have been a topic of intense debate within not just radiology but medicine as a whole (74). The timely detection of a clinically significant finding such as an early-stage malignancy or abdominal aortic aneurysm has the potential to markedly reduce future morbidity, mortality, and cost. Conversely, excessive workup of ultimately benign findings may lead to unnecessary testing, invasive procedures, patient anxiety, and increased cost (Table 3).

Extracolonic findings incidentally detected at screening CTC present a challenge, as the lack of intravenous contrast material and low-dose technique (as compared with standard abdominopelvic CT) may make the characterization of these findings difficult or impossible. The role of the radiologist is to optimize interpretation and guidance for any incidental extracolonic findings detected during screening CTC. Consequently, a clear and concise approach to the classification and reporting of extracolonic findings at screening CTC is beneficial to the interpreting radiologist, the ordering provider, and the patient. Furthermore,

Table 3: C-RADS: Updated versus Original Extracolonic Categories

2005 Original Extracolonic Category	Original Definition	2023 Updated Extracolonic Category	Updated Definition	Incidence (%)*
E0	Limited examination: Compromised by artifact; evaluation of extracolonic soft tissues is severely limited.	E0	Examination inadequate for assessment (category now optional)	3
E1	Normal examination or anatomic variant: No extracolonic abnormalities visible.	E1/E2	No clinically important extracolonic findings or stable previously known extracolonic findings that require no additional workup	86–88
E2	Clinically unimportant finding: No work-up indicated.			
E3	Likely unimportant finding, incompletely characterized: Subject to local practice and patient preference, workup may be indicated.	E3	Likely clinically unimportant finding; further workup may be warranted	4–16
E4	Potentially important finding: Communicate to referring physician as per accepted practice guidelines.	E4	Likely clinically important; further workup needed	2–8

Note.—C-RADS = CT Colonography Reporting and Data System.
* Source—References 3–6, 76, and 86–88.

Table 4: Example Findings by Extracolonic Category

C-RADS Extracolonic Findings Score	Definition	Examples
E1/E2	No clinically important extracolonic findings or stable previously known extracolonic findings that require no additional workup	No extracolonic findings; benign kidney cysts (Bosniak I or II) and liver cysts; adrenal adenoma (according to noncontrast CT criteria); uncomplicated kidney and gallstones; findings that may qualify as E3 or E4 but are previously known and are stable
E3	Likely clinically unimportant finding; further workup may be warranted	Indeterminate cystic adnexal lesions in postmenopausal women lacking suspicious features; indeterminate renal cysts not clearly benign (Bosniak III); increased liver attenuation (≥75 HU), suspicious for iron overload*; calcified gallbladder wall ("porcelain gallbladder"); indeterminate solitary bone lesions
E4	Likely clinically important; further workup needed	Obvious malignancy or lesions with high suspicion for malignancy (eg, spiculated lung mass, Bosniak IV kidney lesion, peritoneal nodularity); bulky lymphadenopathy suspicious for malignancy; abdominal aortic aneurysm >3 cm; staghorn kidney calculus or other urolithiasis causing obstruction; lung airspace consolidation suggesting pneumonia; multiple bone lesions suggestive of metastasis or multiple myeloma; unsuspected osteoporotic fracture

Note.—Adapted, with permission, from reference 1. C-RADS = CT Colonography Reporting and Data System.
* Information on increased liver attenuation from reference 89.

the information provided by the CTC examination for structures outside the colon, while limited for reasons previously described, represents an opportunity for further simultaneous screening, which may add considerable value to the examination.

What follows are revised guidelines for the interpretation and classification of incidentally detected extracolonic findings at CTC, including discussion of additional opportunistic screening that may be performed using CTC source data, and reporting of those screening findings.

Reclassification of Extracolonic Findings

This revision includes minor changes and clarifications from the initial C-RADS guidelines (1). Notably, the prior five-tiered classification system of E0 through E4 is streamlined into a four-tiered system with E1 and E2 combined into an E1/2 category sharing the same management (Table 3). These changes represent a reclassification of extracolonic findings into a scheme intended to be simpler and more clinically meaningful. The actual interpretation of extracolonic findings and assignment of an extracolonic category still relies on the expert determination of the interpreting radiologist. Table 4 provides updated definitions and example findings for extracolonic categories E1/E2, E3, and E4.

Category E0

A survey of the authors of this updated consensus statement determined that the classification of E0 was not often used

in clinical practice. A review of 2021 data from the National Radiology Data Registry for CT Colonography revealed an E0 rate of 3.1% (Courtney C. Moreno, MD, email, November 13, 2023) (75). As extracolonic findings already represent those that are incidental to the primary purpose of screening CTC, the usefulness of a category denoting that the examination is inadequate to assess these findings may be limited. However, it is recognized that there may be an uncommon situation such as a technical issue that may cause the examination to be inadequate for assessment and, therefore, the use of this category is still available but considered optional.

Category E1/E2

Among the most controversial aspects of screening CTC is the rate at which "meaningful" incidental findings are detected and the downstream effects of these findings. There was a lack of uniformity in the reporting of extracolonic findings among early CTC publications. There was also often little or no distinction made between meaningful extracolonic findings and those of no clinical significance. Unfortunately, early reports of the rate of extracolonic findings at screening CTC have been taken out of context. The use of these reports suggested that screening CTC generates unacceptable amounts of follow-up examinations and procedures (76). Fortunately, additional data have shown follow-up rates of CTC extracolonic findings to be reasonably low (3,4,77).

To simplify the interpretation and reporting of extracolonic findings, the previous classifications of E1 (no extracolonic findings) and E2 (clinically unimportant extracolonic findings) are being condensed into a single E1/E2 category signifying no extracolonic findings requiring follow-up examination. This includes the absence of clinically important extracolonic findings or the presence of previously characterized extracolonic findings.

Category E3

The middle tier of the extracolonic classification system is reserved for extracolonic findings that are judged to be indeterminate but likely not clinically important. Depending on the specific clinical scenario and preference of the patient, referring provider, and interpreting radiologist, it may be reasonable to pursue further evaluation of these findings.

Category E4

The highest tier of the extracolonic classification system is reserved for extracolonic findings that are judged by the interpreting radiologist to be likely clinically important. These findings are deemed likely to affect the patient's health in the near future and will, in most cases, require further evaluation and close follow-up or treatment in the near term.

In summary, following the identification of all incidental extracolonic findings, the screening CTC examination is assigned an overall extracolonic findings category of E1/E2 through E4 based on the most clinically significant extracolonic finding (the finding leading to the highest extracolonic finding category).

Opportunistic Extracolonic Screening at CTC

While evaluation of the colon and rectum for polyps and masses is the primary purpose of screening CTC, this cross-sectional imaging examination covers the entire abdomen and pelvis (and the lower thorax)—albeit using a low-dose, noncontrast technique. Consequently, CTC represents an opportunity to screen for cardiometabolic conditions common to patients eligible for colorectal cancer screening. Chief among these is screening for low bone mineral density (osteoporosis) (78,79) and the presence of aortic calcium (80), both of which confer risks for future adverse events. Other opportunistic or incidental CT-based screening opportunities include the assessment of visceral (and subcutaneous) fat (81), muscle (for sarcopenia) (82), and liver fat (for steatosis) (83). All of these CT-based tissue measures can leverage recent advances in artificial intelligence and be fully automated in a rapid and objective manner (81,82,84). The quantification and reporting of these opportunistic cardiometabolic parameters is a rapidly evolving area that is beyond the scope of the current C-RADS revision but will likely be incorporated into future modifications.

Conclusion

The CT Colonography Reporting and Data System (C-RADS) provides a framework to effectively communicate CT colonography (CTC) findings. The core scheme of C-RADS has endured the test of time. For more than 18 years, it has served as an excellent guide for the interpretation and reporting of colonic and extracolonic findings. However, our collective experience with C-RADS has prompted the development of the C-RADS version 2023 update. This update adds a subcategory for mass-like strictures of the colon due to diverticulosis (category C2b), allowing easier differentiation from malignant masses. In addition, a simplification of the classification scheme for extracolonic findings is delineated. The updated four-tiered E0–E4 classification provides a streamlined, clinically practical scheme that will be useful for interpreting and managing incidental extracolonic findings. We hope this update encourages wider adoption of CTC and further standardizes the reporting and management of colonic and extracolonic findings using a simplified, clinically useful standardized lexicon and reporting structure for CTC.

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