Extracolonic Findings Identified in Asymptomatic Adults at Screening CT Colonography

OBJECTIVE. The purpose of this article is to demonstrate the wide variety of extracolonic findings that may be encountered at screening CT colonography (CTC) in asymptomatic adults as well as to discuss the pertinent issues regarding the detection of potential abnormalities in a healthy population.

CONCLUSION. Regardless of whether extracolonic evaluation resulting from CTC screening is viewed as a net benefit or liability, it is an unavoidable responsibility that must be handled with care by the interpreting radiologist. Although many potential abnormalities may be questioned, the pretest probability of clinically relevant disease is quite low in average-risk asymptomatic adults, which may influence subsequent management decisions.

The primary indication for CT colonography (CTC), also known as virtual colonoscopy, is the detection of colorectal polyps and masses. When state-of-the-art technique is applied, CTC represents an effective screening tool that is comparable to optical colonoscopy [1]. Because it is believed that most colorectal cancers can be prevented through effective screening, including asymptomatic adults at average risk, CT colonography is quite distinct from self-referred whole-body CT screening, for which there is currently insufficient scientific data to support routine use [2].

The reality for CTC, however, is that the extracolonic abdomen and pelvis are unavoidably screened in a limited fashion with low-dose, unenhanced CT. Therefore, it is important for radiologists involved in CTC screening to appreciate the unique aspects that surround CT evaluation of healthy adults, where the likelihood of a clinically significant extracolonic finding is very low. A CTC classification system to codify and track extracolonic findings was recently developed and published by the Working Group on Virtual Colonoscopy [3].

Extracolonic evaluation at CTC represents a double-edged sword: the potential benefits include personal reassurance for most adults for whom nothing ominous is found and, in a small minority, discovery of an unsuspected but clinically significant process at an early, presymptomatic stage; the potential limitations include undue anxiety and added costs stemming from additional workup for findings that eventually prove to be of no consequence. Most studies to date on extracolonic findings at CTC have reported on symptomatic or high-risk individuals [4–7]. In contrast, this pictorial essay will focus on extracolonic findings gathered from more than 3,000 CTC studies of asymptomatic adults. Emphasis will be placed on findings that could potentially affect the patient’s health and therefore may require further workup or intervention or cases that can be adequately diagnosed from CTC alone. It is not our intent to provide scientific, evidence-based recommendations but rather to broach an important subplot of CTC screening.

Technique and Handling of Extracolonic Evaluation at CTC

MDCT imaging for CTC at our institution generally entails 1.25-mm collimation, 1-mm reconstruction interval, 120 kVp, and 50–75 mAs. Automatic reconstruction of the supine series to 5-mm contiguous images is performed in all cases to facilitate extracolonic evaluation. Advantages of this approach include fewer images to review (< 100), decreased image noise, and easier archiving and future retrieval since the image-rich original CTC series are stored as a separate source file. Although these 5-mm
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unenhanced images resemble CT examinations obtained for urolithiasis evaluation, there is a fundamental difference: CTC screening patients are asymptomatic. The probability of finding a clinically relevant alternative diagnosis is much greater in the symptomatic “rule out calculus” group, reportedly in the range of 10–30% [8].

For CTC screening of asymptomatic adults, IV contrast material is generally not indicated, in part because its addition would probably not significantly increase polyp detection, particularly when oral contrast tagging is used. Furthermore, it is unlikely that any incremental benefit of IV contrast material would offset the added risks, expense, and time. We specifically mention in our dictated reports that the lack of IV contrast material and low-dose technique limit the evaluation of CT findings outside of the colon.

Although we directly communicate the colonic findings to patients immediately after CTC interpretation, we generally do not relay extracolonic findings directly to patients. This enables the referring physician, who has built a rapport with the patient and is ultimately responsible for arranging further workup, to maintain appropriate control. We do, however, keep a careful log of potentially important extracolonic findings, which we periodically check to confirm resolution. We do not accept self-referred patients for CTC screening but instead require physician referral. This also helps to ensure appropriate follow-up of extracolonic findings, thus eliminating an area of potential weakness from our screening program.

Common Extracolonic CT Findings of Little or No Clinical Significance

A wide variety of minor incidental CT findings, such as uncomplicated renal or hepatic cysts, arterial vascular calcification, calcified granulomata, hernias (particularly hiatal and inguinal), fatty liver, benign skel-
et al findings (e.g., enostosis, hemangioma, degenerative changes), and pelvic phleboliths, are encountered on virtually a daily basis. Except for extreme cases, these findings almost never require further evaluation.

The reported frequency of these findings has varied from 1% to 65% [4–7], perhaps reflecting that many radiologists reasonably choose not to include many of these findings in their reports. For asymptomatic adults undergoing routine CTC screening, benign-appearing low-attenuation renal or hepatic lesions do not require further workup (such as sonography) unless unequivocal complexity is present.
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Published studies have tended to report the frequency of extracolonic findings in terms of “moderate importance” and “high importance” (with “low importance” generally assumed to represent a clinically insignificant finding) [4–7]. This practice greatly overstates the frequency of truly significant extracolonic findings because even most findings reported as highly important ultimately prove to be of no consequence (e.g., a hepatic hemangioma) (Kang PS et al., presented at the 2003 Radiological Society of North America meeting). Therefore, we

Fig. 5—Benign cystic adnexal lesions in asymptomatic women undergoing routine colorectal screening. A, Unenhanced transverse CT image in 59-year-old woman shows large unilocular cyst (C) in right adnexal region and adjacent solid lesion (F), which represents pedunculated broad ligament fibroid. U = uterus. B, Unenhanced transverse CT image in 68-year-old woman shows left adnexal cystic lesion (arrow) that was complex at subsequent pelvic sonography (not shown) and proved to be benign fibroadenoma after surgical resection.

Fig. 6—Unenhanced transverse CT image in asymptomatic 68-year-old man undergoing CT colonography screening shows minimally complicated left renal cyst with thin focal rim calcification (arrow). Lesion was unchanged from CT performed more than 5 years earlier for prostate cancer staging (not shown). Note also cholelithiasis (arrowhead).

Fig. 7—Unenhanced transverse CT image in asymptomatic 57-year-old woman undergoing CT colonography screening shows subtle 5-cm hepatic lesion (arrowheads) not compatible with simple cyst. Lesion was confirmed to represent cavernous hemangioma on dynamic IV contrast-enhanced CT (not shown).
Unsuspected extracolonic malignancy in asymptomatic adults undergoing routine colorectal screening.

A. Unenhanced transverse CT image in 56-year-old woman shows complex solid and cystic left adnexal mass that proved to be papillary serous adenocarcinoma of ovary. Note mural soft-tissue nodule (arrowhead).

B. Unenhanced coronal CT image in 52-year-old man shows solid exophytic mass extending off upper pole of left kidney (arrowheads), which proved to be renal cell carcinoma. This case reinforces utility of multiplanar evaluation because this lesion may be difficult to detect on transverse images alone.

C. Unenhanced transverse CT image in 51-year-old woman shows confluent retroperitoneal lymphadenopathy (asterisk), which was subsequently diagnosed as non-Hodgkin's lymphoma by CT-guided biopsy.

D. Unenhanced coronal CT image in 63-year-old man shows spiculated left lower lobe pulmonary nodule (arrow), which was subsequently diagnosed as non–small cell lung carcinoma by CT-guided biopsy. Patient underwent successful surgical excision of this T1 lesion.
Fig. 9—Congenital variants in asymptomatic adults undergoing routine colorectal screening.

A, Unenhanced coronal CT image in 42-year-old man with family history of colon cancer shows malrotation (nonrotation) with air-filled colon predominately occupying left abdomen and small bowel predominately on right. Absence of duodenal sweep and reversal of normal superior mesenteric artery–superior mesenteric vein relationship were evident on other images (not shown). C = cecum.

B, Unenhanced transverse CT image in 51-year-old man shows multiple small spleens (short arrows), abrupt shortening of pancreas (long arrow), and preduodenal portal vein (arrowhead), all compatible with heterotaxy (polysplenia). ICV interruption was not present but borderline cardiomegaly was suggested on CT scout (not shown); cardiac evaluation has not yet been pursued.

C, Unenhanced transverse CT image in 55-year-old man shows unsuspected horseshoe kidney (arrows). Small calculus was present in left upper pole moiety (not shown).

D, Unenhanced transverse CT image in 54-year-old man shows inferior vena cava duplication (arrows).
report such findings at CTC to be of “potential” importance to underscore both the need for further evaluation and the reasonable likelihood for a good outcome [1].

Cholelithiasis (Figs. 1A and 1B) and nephrolithiasis (Fig. 2) are relatively common findings of potentially moderate clinical importance, with each seen in approximately 5–10% of patients undergoing CTC [1, 4, 5]. Unexpected gallstones are generally seen within an otherwise normal-appearing gallbladder. Of note, we have also encountered asymptomatic choledocholithiasis on several occasions (Fig. 1C). Unexpected renal calculi are typically 5 mm or smaller and without associated hydronephrosis. Indeterminate pulmonary nodules detected in asymptomatic adults are likely benign but may require additional follow-up to confirm stability (Fig. 3). We generally follow the recently published guidelines from the Fleischner Society [9]. The likelihood of detecting an unexpected abdominal aortic aneurysm is largely related to patient age, and the significance is primarily determined by the size of the aneurysm (Fig. 4).

Because most women undergoing CTC are postmenopausal, prominent adnexal lesions often necessitate sonographic follow-up. Findings range from simple-appearing unilocular cysts that are almost certainly benign and prob-
ably nonneoplastic to more complex solid and cystic masses that invariably require surgical evaluation (Fig. 5). Most uniform solid lesions, however, are likely to represent pedunculated fibroids extending into the broad ligament (Fig. 5A). In our experience, the majority of complex cystic renal lesions encountered at CTC are also benign (Fig. 6), although unsuspected renal cell carcinomas will be identified on occasion. Most large indeterminant hepatic lesions identified at asymptomatic screening CTC are subsequently diagnosed as cavernous hemangiomas of essentially no clinical importance on IV contrast-enhanced studies (Fig. 7). Overall, the frequency of extracolonic findings of potentially high importance is much lower among average-risk cohorts (4–6%) [1] compared with higher-risk populations (10–23%) [4, 5, 7]. Fortunately, the majority of these will ultimately prove to be of little or no clinical significance (Kang PS et al., 2003 RSNA meeting).

Unsuspected extracolonic malignancy is relatively uncommon in asymptomatic adults undergoing CTC, with approximately one case per 200 patients screened in our cumulative experience. However, it should be noted that CTC paradoxically uncovers more extracolonic malignancies than colon cancers in this group [1] since the more common target lesion found in an asymptomatic screening population is the potentially precancerous advanced adenoma, not colon cancer itself. To date, we have encountered at least two cases each of unsuspected ovarian cancer, renal cell carcinoma, non-Hodgkin’s lymphoma, and lung cancer (Fig. 8). Detection of malignancy during the presymptomatic phase was probably of real benefit in at least some of these patients.

We have encountered a wide array of incidental congenital variants, only a few of which may impart some clinical significance. Notably, incidental malrotation in adults should not be assumed to automatically represent an insignificant finding since delayed complications can rarely occur [10] (Fig. 9A). Similarly, patients with polypsplenia may evade detection into adulthood if significant congenital cardiac defects are not present [10] (Fig. 9B). More commonly, minor congenital variants of little or no consequence are identified (Figs. 9C and 9D).

An imaging-specific diagnosis is possible on unenhanced CT for a variety of fat-containing lesions in the abdomen and pelvis. Solitary renal angiomyolipomas are most often seen in middle-aged women (Fig. 10A). Adrenal myelolipomas are occasionally identified (Fig. 10B) and, as with angiomyolipomas, are at low risk for spontaneous hemorrhage unless they are large. Nonhyperfunctioning adrenal adenomas tend not to contain macroscopic fat, but rather most contain sufficient amounts of cytoplasmic lipid, allowing confident diagnosis on unenhanced CT (Fig. 10C). Lipomas arising from the gastrointestinal tract (Fig. 10D) or a variety of other abdominopelvic locations can be seen. Fat-containing gynecologic entities include the relatively common benign ovarian teratoma (Fig. 10E) and the rare uterine lipoleiomyoma (Fig. 10F).

In addition to the intended evaluation of the colon and rectum, a variety of incidental focal gastrointestinal lesions may be identified in the distal esophagus, stomach, small bowel, and appendix. Gastrointestinal lipomas have already been discussed (Fig. 10D). We have encountered ileal carcinoid tumors, all of which have been relatively small and without extension beyond the bowel wall (Figs. 11A–11C). Incidental tumors in the more proximal small bowel are rare (Figs. 11D and 11E). Appendiceal findings have included appendicoliths and mucocoeles (Fig. 11F). Benign lesions seen in the esoph-
agus and stomach have included a duplication cyst (Fig. 11G) and a densely calcified leiomyoma (Fig. 11H).

As mentioned above, skeletal findings such as bone islands, degenerative changes, and vertebral hemangiomata are of little or no clinical concern. We have, however, seen several cases of bilateral pars defects (spondylolysis) with varying degrees of spondylolisthesis (Fig. 12)
Fig. 11 (continued)—Noncolorectal gastrointestinal lesions seen in asymptomatic adults undergoing routine screening. 

D and E, Unenhanced transverse CT image with polyp window setting (D) and volume-rendered 3D endoluminal image (E) in 55-year-old woman show incidental polypoid mass (arrowhead, D) in distal jejunum. Lesion proved to be jejunal hamartoma after surgical resection. 

F, Unenhanced curved reformatted sagittal CT image in 63-year-old man shows grossly dilated appendix (asterisk) with subtle mural calcification (arrowheads), consistent with mucocele. Proximal appendix near base appears normal (arrow). Gas-filled sigmoid colon (S) abuts cecum (C). Mucinous adenoma of appendix was confirmed after surgical resection. 

G, Unenhanced transverse CT image in 67-year-old woman shows cystic lesion adjacent to distal esophagus (arrow). Comparison with chest CT performed 2 years earlier showed lesion was stable and is believed to most likely represent foregut duplication cyst. 

(Fig. 11 continues on next page)
that may be of clinical relevance. Unexplained multifocal lytic or blastic lesions have rarely led to further evaluation. An example is unsuspected osseous metastases in one patient with a remote history of breast cancer.

Conclusion
Regardless of whether extracolonic evaluation resulting from CTC screening is viewed as a net benefit or liability, it is an unavoidable responsibility that must be handled with care by the interpreting radiologist. Although many abnormalities will inevitably be uncovered, the pretest probability of clinically relevant disease is quite low among these average-risk asymptomatic adults. In terms of receiver operating characteristic (ROC) analysis, one should perhaps “slide down” the ROC curve somewhat to decrease the false-positive fraction and avoid overcalling extracolonic findings in this cohort, which could have a negative impact on both cost-effectiveness and overall patient care.

References