Original Investigation

Symptomatic Versus Asymptomatic Colorectal Cancer:
Predictive Features at CT Colonography

Matthew H. Lee, MD, J. Louis Hinshaw, MD, David H. Kim, MD, Perry J. Pickhardt, MD

Rationale and Objectives: Computed tomographic colonography (CTC) is a robust tool for evaluating colorectal lesions in both screening and diagnostic settings. The purpose of this study was to assess the relationship between colorectal cancer (CRC) tumor characteristics and patient symptomatology.

Materials and Methods: This is a retrospective analysis of all pathology-confirmed cases of CRC evaluated with CTC at our institution from October 2004 to October 2012. Cases were reviewed to determine tumor size, morphology, and degree of luminal narrowing. An electronic medical record review was performed to delineate specific patient symptomatology and determine depth of invasion.

Results: A total of 55 patients (36 symptomatic and 19 asymptomatic) with a total of 63 CRCs were evaluated by CTC during the study time period. The most common symptoms were gastrointestinal (GI) bleeding/anemia ($n = 26$), followed by obstructive symptoms ($n = 23$), and constitutional symptoms ($n = 5$). Symptomatic cancers were more likely to have annular morphology ($n = 30/43$, 70% vs. $n = 3/20$, 15%; odds ratio [OR] = 13.1, $P = 0.0003$), whereas asymptomatic cancers were more likely to be polypoid ($n = 11/20$, 55% vs. $n = 6/43$, 14%, OR = 7.5, $P = 0.001$). Symptomatic cancers were also larger (46.1 ± 22.4 vs. 38.8 ± 18.4 mm, $P = 0.005$) and resulted in greater luminal narrowing (8.7 ± 8.5 mm vs. 35.8 ± 18.8 mm, $P < 0.0001$) with deeper invasion ($n = 29/35$ [invasion unknown for 8 cases], 83% vs. $n = 6/20$, 30%, OR = 11.3, $P = 0.0003$). Invasive cancers were more likely to have annular morphology (66%, 23/25, $P = 0.002$).

Conclusions: There is an intuitive and predictable relationship between tumor characteristics on CTC and patient symptoms. Annular morphology, tumor size, degree of luminal narrowing, and invasive disease all correlate with the presence of symptoms.

Key Words: CT colonography; colorectal cancer; tumor-related symptoms; tumor characteristics.

INTRODUCTION

Colorectal cancer (CRC) is the third most frequently diagnosed cancer in the United States and is the second deadliest cancer, accounting for 50,310 cancer-related deaths in 2014 (1). Despite current evidence-based screening guidelines, CRC remains a prominent cause of cancer-related mortality, owing in part to suboptimal adherence to recommended screening protocols within the average-risk patient population (2,3).

Early in the time course of disease when prognosis is most favorable, CRC presents in completely asymptomatic individuals. However, as the disease progresses and prognosis becomes worse, symptoms may become evident. Symptoms of obstruction, nausea and vomiting, and abdominal distension are of prognostic significance in CRC patients in terms of both overall survival and disease-free survival (4). Abdominal pain, change in bowel habits, bleeding/anemia, malaise/fatigue, and weight loss (5,6) are among the most common clinical manifestations of CRC prompting medical evaluation. Symptoms of CRC are often attributed to tumor size, location, degree of obstruction, and extent of disease (7).

CT colonography (CTC) has emerged as a robust tool for noninvasive diagnostic imaging of the colon and rectum. Its application is well validated for detecting colorectal neoplasia (8,9), with accuracy equivalent to that of optical colonoscopy (OC) for detecting large adenomas and CRCs (10). Although its greatest potential impact may be as a screening tool for CRC in asymptomatic populations, CTC also has utility in a variety of diagnostic clinical indications including the evaluation of the remainder of the colon in patients with CRC that is occlusive at endoscopy (11).

Over the past decade, the CTC program at our institution has performed approximately 1000 examinations per year. Although the majority of these examinations are a part of a

CRC screening program, there are also diagnostic examinations performed for a variety of clinical indications. The number of pathologically confirmed cases of CRC identified on CTC in both symptomatic and asymptomatic individuals presents an interesting research opportunity. To our knowledge, the relationship between patient symptomatology—or lack thereof—and the appearance of CRC on CTC has not been described previously. The purpose of this study is to determine the predictive features of symptomatic and locally invasive colon cancers evaluated with CTC.

MATERIALS AND METHODS

Study Group

Our retrospective study is in compliance with the Health Insurance Portability and Accountability Act and was approved by the Institutional Review Board at our institution. The requirement for informed consent was waived. Between October of 2004 and October of 2012, 9758 total screening and diagnostic CTC examinations were conducted at our institution. The screening cohort is composed of asymptomatic, average-risk individuals referred to our institution for routine CRC screening, whereas the diagnostic cohort is composed of individuals referred for CTC for a variety of indications including incomplete OC, surveillance for previously diagnosed CRC, and a relative contraindication to OC (e.g. anticoagulation, sedation risk).

CTC Technique

A detailed description of the CTC technique employed at our institution has been previously described (12). A brief description of our technique follows. For screening, we preferentially perform a low-volume bowel preparation 1 day before any screening examination with both cathartic) and dual oral contrast tagging agents. Sodium phosphate was used for catharsis before 2008, replaced by magnesium citrate following this date. Both barium-based (2.1% w/v barium sulfate) and ionic iodine-based (diatrizoate) agents are utilized for tagging. For cases of incomplete colonoscopy, polyethylene glycol was generally given for catharsis. A single 30 mL dose of diatrizoate was given 2–4 hours after recovery from sedation for tagging for the same day CTC procedure.

Pneumocolon was achieved and maintained with automated low-pressure delivery of carbon dioxide. Imaging was performed with 8, 16, or 64 slice MDCT scanners with image reconstruction at 1.25 mm. Images were obtained with the patient in both prone and supine positions, with additional decubitus images obtained as needed. Imaging data were then networked to the institutional picture archiving and communication system (PACS_ and reviewed at a dedicated CTC workstation (V3D Colon, Viatronix)) utilizing a 3D detection and 2D confirmation technique. Clinical interpretation was performed within 2 hours of the study acquisition to allow same-day OC as needed.

Procedures, Classification, and Definitions

Utilizing our clinical CTC database, a search was performed to identify all cases of colorectal adenocarcinoma evaluated with CTC. All pathologically proven cases during the study period were included. These cases were reviewed on the same dedicated CTC workstation. Tumor characteristics were evaluated and recorded by consensus between two authors (MHL and JLH). Size was recorded as length in the greatest tumor dimension regardless of its relationship with the colon lumen. Tumor morphology was determined subjectively and classified as annular, plaque-like, or polypoid. Annular morphology was defined as a "ring-like," concentric lesion involving the colonic wall (Fig 1). Plaque-like lesions were those (1) involving less than 180° of the luminal circumference and (2) with tumor base (width) greater than height (Fig 2). Polypoid lesions were defined as having a tumor height greater than the base (width) (Fig 3).

Next, tumor location was classified according to segmental anatomy including rectum, sigmoid colon, descending colon, transverse colon, ascending colon, and cecum. For lesion location initially interpreted as "hepatic" or "splenic flexure," classification within one of the aforementioned segments was
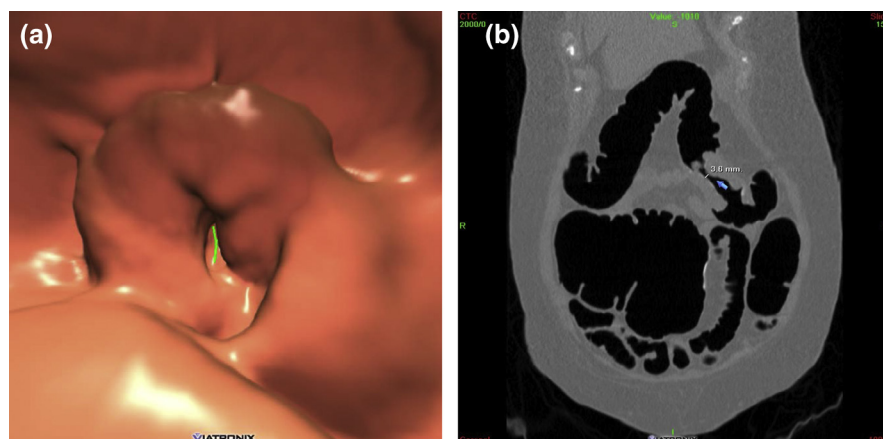

Figure 1. A 76-year-old woman with symptomatic GI bleed and anemia who underwent CTC examination following incomplete optical colonoscopy. Three-dimensional endoluminal CTC **(a)** and corresponding coronal CT **(b)** images show a 49-mm ring-like concentric mass in the transverse colon circumferentially involving the colon wall; the characteristic features of an annular cancer. CTC, computed tomographic colonography; CT, computed tomography; GI, gastrointestinal.