Asian Journal of Surgery (2017) 40, 438–443

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-asianjournalsurgery.com

ORIGINAL ARTICLE

Usefulness of preoperative CT colonography for colon cancer

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Received 8 January 2016; received in revised form 6 April 2016; accepted 11 April 2016
Available online 20 May 2016

KEYWORDS
colon cancer;
colon cancer location;
computed tomographic colonography;
deformity;
feeding artery

Summary *Background:* Computed tomographic colonography (CTC) is reported to be feasible for screening of colorectal polyps; however, its efficacy in preoperative workup remains unknown. This study was done to define our CTC methodology and assess CTC's potential for preoperative examination in patients with colon cancer.
Methods: A total of 86 colon cancer patients underwent CTC prior to laparoscopic colectomy in our department from February 2014 to November 2015. The location of primary colon cancer determined by CTC was compared with that confirmed during the surgery. CTC was performed just after preoperative colonoscopy; for a small colon cancer, we performed clipping during colonoscopy to enhance CTC detectability. We classified wall deformities and compared them with the pathological T stage.
Results: CTC accurately located all 87 primary colon cancers prior to surgery. No patient experienced complications associated with CTC. The deformity classification correlated significantly with the pathological T stage ($p < 0.001$, Kruskal–Wallis nonparametric tests). CTC provided reconstructed images depicting the feeding artery of the primary colon cancer; feeding artery information obtained by CTC facilitated precise lymph node dissection.

Conflicts of interest: None.

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http://dx.doi.org/10.1016/j.asjsur.2016.04.002

Conclusion: CTC appears to be a feasible and useful preoperative examination modality for colon cancer treatment.

1. Introduction

Colorectal cancer is a serious health problem worldwide because of its high frequency and mortality.[1,2] Despite recent progress in chemotherapy, surgical resection is the only curative therapy for colorectal cancer.

Computed tomographic colonography (CTC) was first performed by Vining et al[3] in 1994 at Wake Forest University using volumetric computed tomography (CT) data produced by helical CT scanning. The development of multislice CT and the improvement of workstations and software have facilitated the clinical applications of CTC[4] as alternatives to colonoscopy or double-contrast barium enema (DCBE) for the screening and detection of colorectal polyps.

Recently, laparoscopic surgery has become common, and in randomized trials it has shown results comparable to those of open surgery.[5] In laparoscopic colectomy, because palpation during the procedure is not feasible, accurate preoperative localization is crucial, especially that of lesions that are not apparent on the serosal surface. Therefore, knowing the exact location of the tumor is of utmost importance, particularly for effective colectomy and lymph node dissection. Several studies have evaluated the usefulness of CTC in preoperative evaluation. Nagata et al[6] reported that the detectability of colonic lesions by CT enema was 97% (319/328). CTC has also been reported to be a valuable tool for evaluating the proximal colon in incomplete colonoscopy caused by stenosis in large colon cancer.[7,8] These studies, however, do not address the problems of locating lesions undetected by CTC.

In this study, we describe our approach to the detection and localization of small preoperative cancers and evaluate its potential role in the preoperative examination of patients with colon cancer.

2. Materials and methods

2.1. Patients

We reviewed our registry from February 2014 to November 2015. Eighty-six colon cancer patients underwent preoperative CTC and laparoscopic colectomy with lymph node dissection. We had just begun to perform CTC in February 2014 and applied CTC only to colon cancer patients; patients with rectal cancer were therefore excluded from this study. Patients with obstructions were also excluded. We obtained written informed consent concerning CTC prior to the examination from all patients.

2.2. CTC technique

First, all patients underwent 2 L of polyethylene glycol lavage as a full preparation prior to total colonoscopy, which was performed by experienced gastroenterologists, immediately followed by CTC. If a small cancer ($<$ 10 mm) was detected in colonoscopy, then metallic clips (HX-610-090; Olympus, Tokyo, Japan) were endoscopically applied to the cancer site with a roticulator clip-fixing device (HX-110UR; Olympus) to ensure CTC locatability of small cancers.

The patient was placed on the multislice CT scanner (Aquilion One Vision Edition or Aquilion PRIME; Toshiba Medical Systems, Tochigi, Japan) in the left lateral decubitus position. Thereafter, carbon dioxide gas was infused through a balloon catheter placed in the rectum with an automated insufflation device (PROTOCO2L; EIDIA, Tokyo, Japan) equipped with a pressure monitor. The patient was rotated to the supine position 1 minute after the start of insufflation to transfer the gas into the transverse colon. When the infusion volume reached 2 L or more and the intracolonic pressure was stable at 18 $\pm$ 2 mmHg, a CT scanogram was done to confirm that sufficient colonic expansion was obtained. Then, abdominopelvic CT scans were performed. The patient was subsequently rolled over to the prone position while the gas insufflation was continued. When the enteral pressure stabilized at 18 $\pm$ 2 mmHg and sufficient colonic expansion was confirmed by another scanogram, a CT scan covering the entire colon and rectum was performed. Thin-slice CT images were reconstructed from the volumetric CT data and then transferred to a dedicated workstation (Advantage Workstation; GE Healthcare Japan, Tokyo, Japan), which allowed visualization of two-dimensional axial and multiplanar reformatted images, three-dimensional endoluminal surface-shaded volume rendering images, and DCBE-like images (Figure 1). Radiologists blind to the results of colonoscopy interpreted the CTC studies.

As a preoperative examination of cancers, we performed CT scans after injecting contrast media unless contraindications were present at the same time as CTC. Three-dimensional images of the feeding artery of the primary cancer were reconstructed to ensure safe and adequate lymph node dissection.

2.3. Data analysis

We reviewed the clinicopathological data—sex, age, characteristics of cancers, and complications related to CTC. The cancers' location, size, morphological type, grade of invasion, and differentiation determined pathologically were reviewed. The morphological type was classified in accordance with the Paris—Japanese classification[9]: Type 0,