

Preoperative staging of resectability of colon cancer using virtual colonoscopy: correlation with surgical results.

Our experience



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Preoperative staging of resectability of colon cancer using virtual colonoscopy: correlation with surgical results. Our experience

PURPOSE: To evaluate the clinical usefulness of preoperative computed tomography colonography (CTC) in locoregional staging in patients with abdominal pain secondary to occlusive colorectal cancer (CRC).

MATERIALS AND METHODS: 80 patients with abdominal pain underwent CTC initially without contrast and after diagnosis with contrast. 47 patients had distal CRC and 33 had proximal CRC. CT images were analyzed independently by two radiologists, using MPR reconstruction and VR images. Depending on the anatomical depth of wall invasion primary tumor (T) was classified $\leq T_2$, T₃ and T₄. The definition of node disease (N) was based on the number of involved regional lymph nodes. Metastases (M) were characterized by the presence and location of distant disease. Pre treatment stage (cT cN) was compared with pathologic stage (pT pN). Accuracy of CTC was also evaluated.

RESULTS: The overall accuracy values for T staging of reviewer 1, reviewer 2 and consensus reading were 91.6%, 86.2% and 92.8% respectively; 92.2%, 79.8% and 92.5% for T₂; 88.1%, 85.5%, and 89.7% for T₃; and 94.5%, 93.5% and 96.2% for T₄. The accuracy values for N staging and M staging were 81.8%, 94.0% for reviewer 1; 78.2% and 88.1% for reviewer 2; 81.8% and 94.0% for consensus reading, respectively.

CONCLUSION: In our experience CTC is not only useful in the evaluation of the proximal bowel, but can also provide surgeons with accurate information about staging and tumor localization. CTC is recommended for better evaluation of preoperative staging.

KEY WORDS: CT colonography, Colorectal cancer, Extracolonic findings, Staging

Introduction

Colorectal cancer (CRC) is the second cause of cancer related deaths in the western world (2.7–2.8%)¹. Most

CRC arises from adenomatous polyps that can change into invasive cancer and this process can take more than 10 years^{2,3}.

Conventional colonoscopy (CC) is the current standard technique for evaluating the entire colon. Nowadays, computed tomography colonography (CTC) is regarded as a promising technique for complete evaluation of the entire volume of the colon and simultaneous assessment of extraluminal status.⁴⁻⁶

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Several articles discuss the usefulness of CTC in the occlusive CRC, focusing on distal colon or rectum. These promising results have promoted CTC as a choice for preoperative evaluation in occlusive CRC, considering that Conventional CT can not accurately determine the depth of invasion or evaluate tumor foci in non enlarged lymph nodes. The aim of this study was to evaluate the clinical usefulness of CTC in occlusive CRC and to compare CTC staging with surgical results.

Materials and Methods

From January 2008 to August 2009, 80 patients, 53 men and 27 women (mean age of 64 years with a range of 42 - 86 years) with occlusive pain and occlusive CRC underwent CTC. The tumors were initially diagnosed by ultrasonography (1 case), clinical suspect (21 cases) and CC (in 58 patients). Bowel "tagging" was provided by ingesting 200 ml of ditiazolato dimeglumine (Gastrografin) one day before the exam, 100 ml before and 100 ml 2 hour later.

Informed consent was obtained from all the patients and all examinations were performed in accordance with the recommendations of our Institutional Review Board.

CTC was performed with a 64 multi-detector row CT scanner (Somatom Sensation 64, Siemens, Erlangen, Germany). No spasmolytic or buscopan (hyoscine n-buthylbromide) were used. Room air was carefully insufflated using a manual balloon pump through a rectal enema tube of 22 G according to the patient's tolerance. Air filling and distension of the colon were evaluated initially on the CT scout before CTC. Once bowel distension was adequate, CTC was performed with two sets of images, one obtained with the patient in prone position (no contrast scan) and the second one with the patient in supine position. In the supine position injection of 2 ml/kg of an iodinated contrast agent (3 mL/sec; scanning delay, 65 sec). CT parameters included 2,5 × 1,2 mm detector collimation, 120 kV, 50 mAs (prone) - 200 mAs (supine), and a pitch of 1.25. Axial CT images were reconstructed as 1-mm slices with a 1-mm reconstruction interval. CT images were transferred to a remote PC-based workstation using commercially available software (Im3d, Turin, Italy). The processed images included multiplanar reformatted and virtual colonoscopy images.

CT images were analyzed independently by two radiologists assessing on a dedicated workstation with advanced imaging analysis software. MPR reconstruction and VR images were evaluated. Depending on the anatomical depth of wall invasion primary tumor (T) was classified ≤ T2, T3 and T4. The definition of node disease (N) was based on the number of involved regional lymph nodes; lymph nodes ≥ 1 cm were considered pathological. Metastases (M) were characterized by the presence and location of distant disease.

Post procedure CC wasn't performed to control the CTC findings, all the patients went to surgery immediately. Surgical resection was performed in all patients, after multi-disciplinary team planning with surgeons, internists, and radiologists. Pre treatment stage (cT cN) was compared with pathologic stage (pT pN). Accuracy of CTC was also evaluated.

Results

Complete CTC examination was achieved in all 80 patients who underwent CTC with occlusive pain and occlusive colon cancer. 33 patients had proximal CRC cancer and 47 patients had distal CRC. 80 adenocarcinomas were retrieved from 73 patients.

The overall accuracy values for T staging of radiologist 1, radiologist 2 and consensus reading were 91.6%, 86.2% and 92.8% respectively; 92.2%, 79.8% and 92.5% for ≤ T2; 88.1%, 85.5%, and 89.7% for T3; 94.5%, 93.5% and 96.2% for T4 (Fig. 1). Three of 14 T4 lesions were under staged due to inadequate distension (n=1) and misinterpretation of adjacent organ involvement as partial volume averaging (n=2). The accuracy values for N staging and M staging were 81.8%, 94.0% for radiologist 1; 78.2% and 88.1% for radiologist 2; and 81.8% and 94.0% for consensus reading, respectively.

The overall accuracy for prediction of positive N was 80%. Intra-abdominal metastatic lesions were found in 11 patients, located in liver (n = 3), lung (n = 1), peritoneal dissemination (n = 6) and central nodal (n = 3). In determination of peritoneal dissemination, one patient was over-staged and one was under-staged.

CT colonography provided precise information on tumor location.

A total of seven synchronous carcinomas (9%) were confirmed: 4 in the colon proximal to the occlusion and 5 distal to the occlusion. All of them were correctly diagnosed preoperatively by CTC. Sixteen lesions (including 3 synchronous colorectal cancers) were detected distal to the occlusive cancer in 12 patients.

Discussion

At present, CT is regarded as a routine procedure for preoperative evaluation in patients suspected of having advanced CRC⁷⁻⁹. Mauchley et al. suggested that routine preoperative CT provides information that definitely changes treatment in 16% patients and is good cost-effective. The accuracy of T staging by CT is also not satisfactory, ranging from 53 to 77%⁹⁻¹³. Recent multi-detector row CT (MDCT) scanners allow thinner collimation, resulting in marked improvement of scanning resolution. Accordingly, MDCT with virtual endoscopy and/or multiplanar reformation could improve the accu-

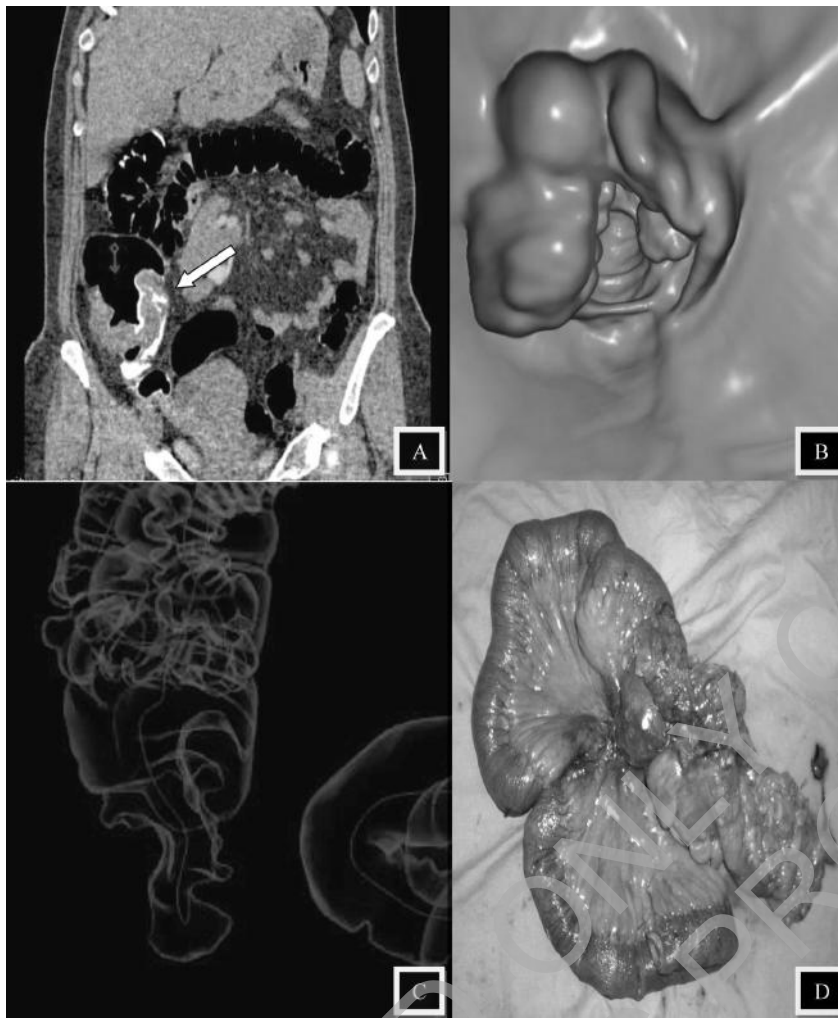


Fig. 1.: 49 year female with occlusive colon cancer in the cecum (white arrow). (A) Coronal image of colon cancer with invasion of the fatty tissue of abdomen (T3); (B) endoluminal CTC image clearly shows this carcinoma; (C) The virtual double-contrast display demonstrates an annular circumferential mass in the cecum. (D) Surgical macroscopic image of the tumor.

racy of preoperative T and N staging with only whole body evaluation¹⁴⁻¹⁶. In our study, the accuracy of T staging was 92,8% in consensus reading.

Total large bowel evaluation is important in planning the treatment of patients with CRC because synchronous adenomas and adenocarcinomas are found in 14 - 48% and 2-9% of such cases, respectively¹⁷⁻²⁵. Although CC is still the gold standard for the evaluation of the colon for CRC, it may be incomplete due to tumor obstruction, which is a frequent event in distal cancers^{4,26}.

We observed many cases in which CRC lesions seemed to be in the proximal colon were actually located in distal colon. Some articles reported that CC had a considerable error rate for CRC localization and resulted inaccurate in 11-21% of cases²⁷⁻³⁰. Anatomic variation and absence of fixed internal landmarks make it difficult to localize the tumor accurately. Furthermore, in occlusive CRC, tumor localization may be more difficult, even for experienced endoscopists, because inferring tumor location from the ileo-cecal valve is impossible. CC resulted inaccurate in tumor localization in 21% of

occlusive CRC cases, and there were clinically significant localization errors in 11% of occlusive CRC cases that required modification of surgical approach.

Accurate tumor localization for rectal carcinomas also has substantial clinical importance for preventing the inappropriate use of adjuvant therapy and determining the proper surgery, such as segmental sigmoid resection, low anterior resection, or abdominoperineal resection³⁰. Preservation of the anal sphincter depends on the distance between the lower edge of the tumor and the external sphincter and levator ani muscle. CTC may provide an objective measurement of the distance of the tumor from the anal verge, which is mandatory for rectal surgery.

N staging represented the major problem, because many patients with lymph nodes larger than 1cm were classified as pathological, but didn't show pathological results at the postoperative histological examination. In our study, 81,8% of patients with lymph node involvement were correctly staged, whereas 18,2% were over staged, by MDCTC. In all over staged cases, over staging was caused by the presence of reactive nodes larger than 1

cm. Although the superiority of MRI in the detection of lymph node involvement has been documented in early reports, Ergen et al. reported poor agreement between MRI and surgical pathologic staging³¹⁻³²; however, the role of MDCT and MRI in the assessment of regional lymph node involvement has not been evaluated in large clinical series. PET/CT, with its high sensitivity is nowadays considered a useful screening method in the evaluation of regional lymph node metastasis.

As regards extra colonic findings, published studies have tended to report the frequency of extra colonic findings in terms of "moderate importance" and "high importance" (with "low importance" generally assumed to represent a clinically insignificant finding)³³⁻³⁶. In our experience excluding all those injuries found in stage N and M, the surgical approach was modified because of extra colonic findings (2 cases) or a right pelvic kidney with abnormal course of the ureter passing close to the surgical area; in this case, there was an intussusception on a chronic inflammatory bowel disease.

CTC can provide important information in management of patients with CRC. It is an accurate imaging modality to properly stage disease and evaluate extra-colic abnormalities. CTC should be the modality of choice in preoperative evaluation of all CRC. CTC with "fecal tagging" approach is useful not only for evaluation of the occlusive CRC, but also for accurate staging and tumor localization.

Riassunto

SCOPO DELLO STUDIO: Lo scopo del nostro studio è stato quello di valutare l'utilità clinica e l'attendibilità della colonscopia TC virtuale (CTC) in pazienti con dolore addominale per cancro del colon-retto in fase occlusiva (CRC) in base alla localizzazione del tumore.

MATERIALI E METODI: Abbiamo sottoposto a colonscopia TC virtuale (CTC) 80 pazienti con dolore addominale inizialmente senza mezzo di contrasto e, dopo la diagnosi, con mezzo contrasto. 47 pazienti avevano un cancro localizzato nel colon distale e 33 nel colon prossimale. Due radiologi con diversa esperienza hanno analizzato le immagini usando ricostruzioni MPR e immagini VR. Ai radiologi è stato chiesto di determinare la profondità di invasione della parete del colon (stadio T) classificandola in $\leq T_2$, T_3 , T_4 e la stadiazione N ed M. Abbiamo analizzato retrospettivamente i risultati chirurgici e correlato i risultati della colonscopia virtuale e tradizionale.

RISULTATI: I valori complessivi di accuratezza per lo stadio T del 1° radiologo, del 2° radiologo e la conformità di lettura sono stati rispettivamente di 91,6%, 86,2% e 92,8%; 92,2%, 79,8% e 92,5% per $\leq T_2$; 88,1%, 85,5% e 89,7% per T_3 ; e il 94,5%, 93,5% e 96,2% per T_4 . I valori di accuratezza per la stadiazione N e M sono stati

81,8%, 94,0% per il 1° radiologo; 78,2% e il 88,1% per 2° radiologo; la conformità di lettura è stata rispettivamente di 81,8% e il 94,0%.

CONCLUSIONI: Nella nostra esperienza la colonscopia virtuale è risultata utile, e in alcuni casi indispensabile, per la localizzazione del tumore nell'intestino prossimale. Inoltre può anche fornire ai chirurghi informazioni accurate sulla stadiazione e la localizzazione del tumore. La colonscopia virtuale è raccomandata per una migliore stadiazione preoperatoria.

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