European Journal of Radiology, 11 (1990) 150–153
Elsevier

EURRAD 00074

Preoperative CT staging of colon carcinoma (excluding the recto-sigmoid region)

B. Acunaş [1], I. Rozanes [1], G. Acunaş [1], L. Çelik [2], I. Sayi [1] and E. Gökmen [1]

[1]*Department of Radiology, İstanbul University Medical Faculty, Çapa and* [2]*Department of Radiology, Haydarpasa Numune Hospital, İstanbul, Turkey*

(Received 3 January 1990; accepted after revision 30 March 1990)

Key words: Computed tomography, colon; Computed tomography, staging; Colon, staging; Colon, neoplasm; Colon, computed tomography

Abstract

Twenty-eight patients with colon carcinoma (excluding the recto-sigmoid region) underwent preoperative staging with computed tomography (CT). The CT had a sensitivity and a specificity of 60 and 67% for detection of extramural invasion, 75% sensitivity and specificity for lymph node metastases and a sensitivity of 87% and specificity of 95% for liver metastases. Compared with the modified Dukes classification, CT correctly staged 50% of the patients with Dukes A lesions; 40% with Dukes B; 75% with Dukes C and 85% with Dukes D lesions. The data presented in this study showed that CT has limitations in the sensitivity and accuracy of staging local colonic carcinoma. However, we recommend its use for patients who are clinically suspected of having extensive disease.

Introduction

The accuracy of CT staging of carcinoma of the colon is still controversial. Initial reports have shown staging accuracy rates of 90–100% [4,7]. Later studies reported CT to be only 48–74% accurate, with accuracy rates for detecting lymph node metastases ranging from 25 to 73% [1,3,8]. Based on these later reports, the general opinion was that routine preoperative CT staging of colon carcinoma is useless and should not be recommended [1,3,8]. However, most investigators have attempted to stage recto-sigmoid carcinomas, but there is insufficient data for the more proximal tumors. In this study, we report the results of the preoperative CT staging of colon carcinoma, excluding the recto-sigmoid region in 28 patients.

Materials and Methods

Preoperative CT scans of 28 patients with a diagnosis of colon carcinoma were reviewed prospectively. The diagnoses of the tumors were established by barium enema and/or by colonoscopy. In every case, the diagnosis was confirmed by pathologic evaluation of the gross specimens.

The scans were obtained on a Siemens Somatom DR H scanner. Axial images covering the entire abdomen and pelvis, from the dome of the diaphragm to the anal verge were obtained. In addition, thin sections were obtained in the regions of interest. The patients received oral and rectal contrast in the form of 2% diluted iodinated contrast material. The examinations were started with a bolus i.v. administration of 100 cc lohexol 300 mgI/ml (Nycomed, Norway) using a dynamic scan technique with an 8 mm section thickness and 8 mm increments. This series included 19 men and 9 women ranging in age from 23 to 69 years (mean: 54 years). The locations of the tumors were as follows: caecum, 8 cases; ascending colon, 6; hepatic flexure, 2; transverse colon, 5; splenic flexure, 1; descending colon, 6.

The CT staging of the colon carcinomas was performed according to the following parameters, which comply with the modified Dukes classification (Table 1).

Address for reprints: Bülent Acunas, MD., Department of Radiology, İstanbul Medical Faculty, Çapa 34390, İstanbul, Turkey.

TABLE 1

The modified Dukes classification

Stage
A Tumor limited to colonic wall.
B Spread by direct extension to serosa and/or pericolic fat.
C Involvement of regional nodes.
D Involvement of adjacent organs; peritoneal, distal metastases; and/or liver metastases.

(a) Demonstration of soft tissue densities and/or adjacent linear strands extending into the pericolic fat were accepted as extramural invasion.

(b) 1 cm or larger regional lymph nodes and/or clusters of three or more nodes (each <1 cm) were considered as positive for metastases.

(c) Involvement of adjacent solid or hollow organs, intraperitoneal and mesenteric implants and liver metastases were evaluated as distant metastases. The preoperative CT findings were compared with the surgical findings and the results of the histological examinations of the resected specimens.

Results

Extramural invasion

The results of the CT detection of local tumor extension are as follows: true-positive, 15 cases; true-negative, 2; false-positive, 1; false-negative, 10. Thus CT had a sensitivity of 60%, specificity of 67%, accuracy of 61%, and predictive values of positive and negative examinations of 94 and 17%, respectively (Fig. 1).

The false-negative examinations were usually due to microscopic extension of tumor beyond the serosa.

Regional lymph nodes

The main limitation of CT is the high rate of false-negative findings in the evaluation of regional lymph nodes. For this reason, we have applied strict criteria and considered 1 cm or larger regional lymph nodes and/or clusters of 3 or more nodes (each <1 cm) positive for metastases. Histopathologic examination was considered as the definite test to confirm lymph node invasion if tumor cells were found within a lymph node regardless of the size of the lymph node. The results of CT detection of lymph-node metastases are as follows: true-positive, 18; true-negative, 3; false-positive, 1; false-negative, 6. CT had a sensitivity, specificity and accuracy of 75% each, and predictive values of positive and negative examinations of 95 and 33%, respectively (Figs. 2, 3 and 4).

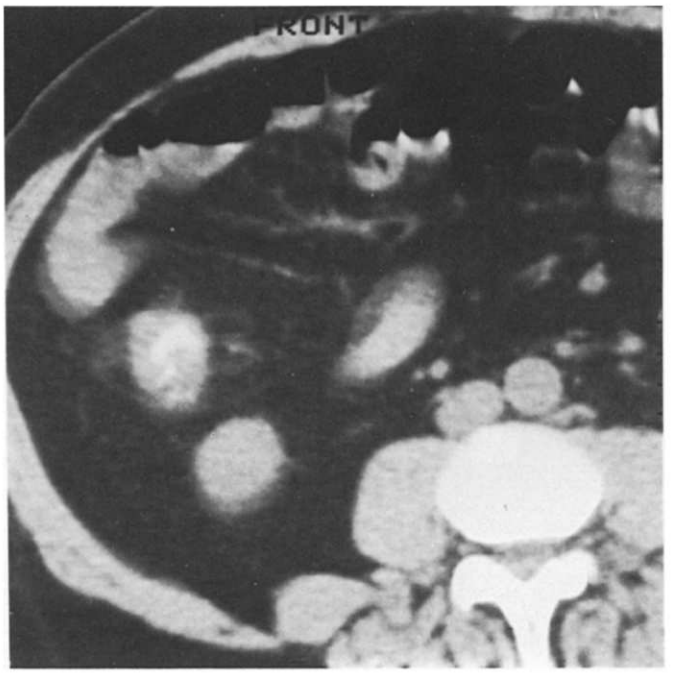

Fig. 1. An annular carcinoma with soft-tissue densities in the adjacent pericolic fat. Dukes B lesion. CT findings were confirmed by histology.

Fig. 2. A large carcinoma of the caecum with soft-tissue densities and clusters of lymph nodes in the adjacent pericolic fat. Dukes C lesion. CT findings were confirmed by histology.

The false-negative examinations were usually due to microscopic invasion in normal sized lymph nodes.

Distant metastases

Eight patients had hepatic metastases confirmed by careful palpation during surgery and histological examination of the resected specimen or CT-guided percutaneous thin-needle aspiration biopsy and cytology. The results of the detection of hepatic metastases were

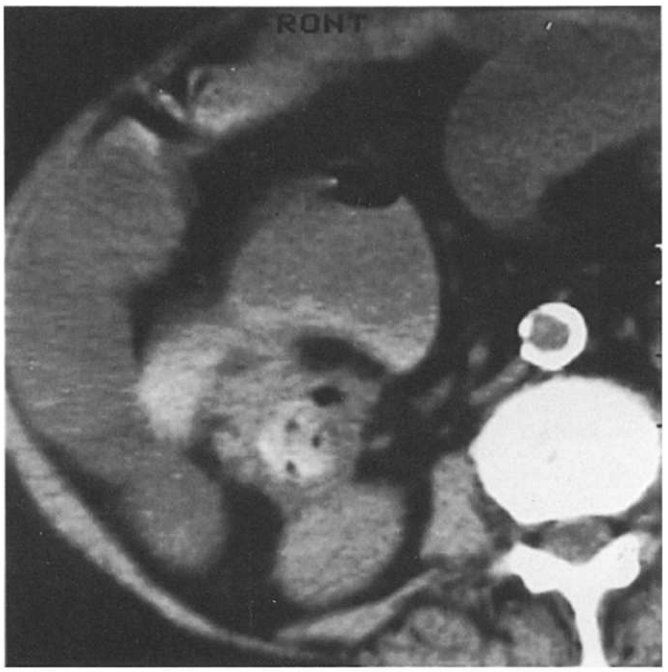

Fig. 3. An ascending colon carcinoma with invasion into the right kidney. Dukes D lesion. CT findings were confirmed by histology.

Fig. 4. A large colonic mass with pericolic soft-tissue densities and clusters of lymph nodes, which has invaded the mesentery and adjacent ileum. Dukes D lesion. CT findings were confirmed by histology.

as follows: true-positive, 7; true-negative, 19; false-positive and false-negative, one each. CT had a sensitivity of 87%, specificity of 95%, accuracy of 93%, and predictive values of positive and negative examinations of 87 and 93%, respectively. CT correctly staged seven of the eight cases with adjacent organ invasion (Figs. 3 and 4).

Table 2 summarizes the sensitivities, specificities, positive and negative predictive values and accuracy of CT in detecting the parameters used to stage colonic carcinoma.

CT vs. Dukes classification

When compared with the modified Dukes classification, CT correctly staged 71% of all cases. CT correctly staged one of two patients with Dukes A lesions, two of five patients with Dukes B, six of eight patients with Dukes C and eleven of 13 patients with Dukes D lesions.

Discussion

Although the detection rates of colonic carcinomas by barium enema and/or colonoscopy is quite high, neither has the capacity to enable preoperative staging. Various imaging techniques such as CT, US and MR have been proposed to depict local invasive and metastatic disease; however, so far none of them have proven to be an alternative to surgical and pathological staging.

CT has been extensively evaluated for the preoperative staging of (particularly) rectal carcinoma. Initial reports were encouraging, but later studies showed that CT was only 48–74% accurate, with accuracy rates for lymph node metastases ranging from 25 to 73% [1,3,8]. On the basis of these later studies it has been postulated by some researchers that due to the poor accuracy of CT in the preoperative staging of recto-sigmoid carcinoma, it has virtually no useful clinical role. The role of MR imaging in the staging of recto-sigmoid carcinoma is very limited. In one study, it was found that MR and CT were equally effective in the staging of rectal carcinoma, but MR imaging could not depict the extent of bowel wall infiltration and tumour spread to normal-sized lymph nodes [2]. It has been proved that transrectal US is useful in depicting the depth of tumor spread into perirectal fat and lymph nodes [5]. US of the colon appears promising but it is still under development [6].

As stated before, CT has been extensively evaluated for carcinoma of the recto-sigmoid region, but there are few data for the more proximal tumors. Our study has shown similar accuracy rates as recent studies on the staging of colon carcinoma. Although the number of our cases was too limited to make a definite statement, CT did not seem to achieve a sufficiently high sensitivity to be considered clinically useful in Dukes A and B lesions. It had a moderately high sensitivity in detecting

TABLE 2

Results of CT staging with surgical/pathological findings (n = 28)

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
Extramural invasion	60	67	94	17	61
Regional lymph nodes	75	75	95	33	75
Liver metastases	67	95	87	93	93

Dukes C lesions, and a high sensitivity in detecting Dukes D lesions.

Knowledge of the extent of tumor spread prior to surgery could have a significant impact on the therapy. In case of extensive disease, radical surgical resections with its high morbidity and mortality rates may be considered useless; instead of extensive curative procedures, limited resection may be performed; resection of hepatic metastases may be planned; preoperative chemotherapy and/or radiation may be indicated. Patients with limited liver metastases from colorectal carcinoma, who do not undergo hepatic resection rarely survive for more than 2 years after diagnosis [9]. On the other hand, the 5 year survival rates after curative resection of the metastatic foci are about 30% [9]. For the detection of hepatic metastases, dynamic CT is considered the most sensitive modality [10].

We therefore recommend pre-operative CT staging of colon carcinoma in patients who are clinically suspected of having extensive disease.

References

1 Balthazar EJ, Megibow AJ, Hulnick D, Raidich DP. Carcinoma of the colon. Detection and preoperative staging by CT. AJR 1988; 150: 301–306.

2 Butch RJH, Stark DD, Wittenberg J et al. Staging rectal cancer by MR and CT. AJR 1986; 146: 1155–1160.

3 Freeny PC, Marks WMN, Ryan JA, Bolen JW. Colorectal carcinoma evaluation with CT: preoperative staging and detection of postoperative recurrence. Radiology 1986; 158: 347–353.

4 Mayes GB, Zornoza J. Computed tomography of colon carcinoma. AJR 1980; 135: 43–46.

5 Rifkin MD, Marks GJ. Transrectal US as an adjunct in the diagnosis of rectal and extrarectal tumors. Radiology 1985; 157: 499–502.

6 Takemoto T, Aibe T, Fuji T, Okita K. Endoscopic ultrasonography. Clin Gastroenterol 1986; 5: 305–319.

7 Thoeni RF, Moss A, Schnyder P, et al. Detection and staging of the primary rectal and recto-sigmoid cancer by computed tomography. Radiology 1981; 141: 135–138.

8 Thompson WM, Halvorsen RA, Foster WL Jr, Roberts L, Gibbons R. Preoperative and post-operative CT staging of recto-sigmoid carcinoma. AJR 1986; 146: 703–710.

9 Adson MA, Von Heerden JA, Adson MH, Waguer JS, Ilstrup DM. Resection of hepatic metastasis from colorectal cancer. Arch Surg 1984; 119: 647–651.

10 Foley WD, Berland L, Lawson TL, Smith DP, Thorsen MK. Contrast enhancement technique for dynamic hepatic computed tomographic scanning. Radiology 1983; 147: 797–803.