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Risk factor assessment to predict the likelihood of a diagnosis of metastasis for indeterminate hepatic lesions found at computed tomography in patients with rectal cancer

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AIM: To assess the significant factors on rectal magnetic resonance imaging (MRI) to predict the likelihood of a diagnosis of metastasis for indeterminate hepatic lesions found at computed tomography (CT) in patients with rectal cancer.

MATERIALS AND METHODS: A total of 207 patients with rectal cancer who underwent preoperative contrast-enhanced abdominopelvic CT, and rectal and liver MRI were included. Univariate analysis and multivariate logistic regression were used to evaluate the determining factors for the significance of indeterminate hepatic lesions on CT in patients with rectal cancer.

RESULTS: Hepatic metastases were diagnosed in 29 (20.9%) of 139 patients who had indeterminate hepatic lesions on preoperative CT obtained for rectal cancer. On univariate analysis, carcinoembryonic antigen level, N stage, mesorectal fascia (MRF) invasion, diameter of superior haemorrhoidal vein, and mesorectal vascular lesion (MVL) grade on rectal MRI ($p<0.05$) were associated with the possibility of metastasis for indeterminate hepatic lesions on CT. On multivariate analysis, MVL grade and MRF invasion on rectal MRI were independent factors associated with the possibility of metastasis for indeterminate hepatic lesions on CT ($p<0.0005$ and $p=0.0066$, respectively).

CONCLUSION: MVL grade and MRF invasion on rectal MRI are independent factors for estimating hepatic metastasis among indeterminate hepatic lesions on CT in patients with rectal cancer.

Introduction

Liver is the most common organ in which metastasis occurs in patients with rectal cancer,[1,2] and patient survival can be improved by surgical resection of hepatic metastases.[3–6] Contrast-enhanced abdominopelvic computed

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tomography (CT) is the primary imaging technique for preoperative staging of rectal cancer and metastasis, but sometimes detection and characterisation of hepatic metastases are limited with contrast-enhanced CT. On CT, discrete differentiation of small hepatic metastases from incidental benign lesions, such as small cysts, focal fat infiltration, haemangioma, and eosinophilic infiltration, is not always easy. Therefore, these lesions might be considered as indeterminate on CT.[7]

With recent advances in magnetic resonance imaging (MRI) including diffusion-weighted imaging (DWI) and gadoxetic acid (Primovist, Bayer Schering Pharma, Berlin, Germany), the higher accuracy of MRI as compared to CT for diagnosing hepatic metastases of rectal cancer has been demonstrated in several studies.[7–9] Liver MRI could be considered to evaluate whether patients with potentially curable hepatic metastases; however, there are no studies that have reported on indeterminate hepatic lesions detected with CT in patients with rectal cancer regarding the use of liver MRI.

Recent studies have shown that adverse features found on rectal MRI identify patients with rectal cancer at higher risk of distant metastasis.[10–13] Distant metastasis in patients with rectal cancer was closely linked to high T stage, positive regional lymph node metastasis, lymphovascular invasion, and involved circumferential resection margins on rectal MRI. Therefore, the clinical significance of indeterminate hepatic lesions on CT in patients with rectal cancer may differ depending on such rectal MRI findings.

The purpose of the present study was to assess the significant factors on rectal MRI to predict the likelihood of indeterminate hepatic lesions on CT as metastasis in patients with rectal cancer.

Materials and methods

Study population

This retrospective study was approved by the institutional review board and the requirement for informed consent was waived. The histopathological and radiological databases were searched retrospectively using the search terms “rectal cancer” between 2011 and 2014. Patients who met the following inclusion criteria were selected for study inclusion: (a) patients with histopathologically proven rectal cancer; (b) no history of previous or coexisting other malignancy; (c) patients who underwent preoperative contrast-enhanced abdominopelvic CT, high-resolution rectal MRI for local staging of rectal cancer, and liver MRI according to the standard protocol; and (d) liver MRI obtained within 1 month prior to or after preoperative contrast-enhanced abdominopelvic CT and rectal MRI. Among these patients, 81 patients were excluded for the following reasons: (1) patients who had any form of treatment before undertaking rectal or liver MRI (n=55), (2) patients with recurrent rectal cancer (n=4), (3) patients with squamous cell carcinoma (n=3), or (4) liver MRI was undertaken for evaluation of primary liver cancers or bile duct cancers (n=19), which showed typical imaging findings of hepatocellular carcinoma (n=11) or hilar cholangiocarcinoma (n=8). A total of 207 consecutive patients (138 men and 69 women; mean age, 60 years; range 27–84 years) were included in the study. Of them, hepatic metastases were diagnosed in 85 patients based on the following clinicopathological results: (a) by surgical resection (n=31) or biopsy (n=5); or (b) the lesion featured typical imaging findings of metastasis on liver MRI[9,14–16] and showed interval growth, size reduction after chemotherapy, or hypermetabolism at combined 2-[^{18}F]-fluoro-2-deoxy-D-glucose positron-emission tomography(FDG PET)/CT (n=49). Benign hepatic lesions were diagnosed in 108 patients based on following findings: (a) the lesion showed typical imaging findings of cyst, haemangioma, or focal fat infiltration on liver MRI (n=83)[17]; (b) the lesion remained stable for more than 12 months or resolved at follow-up imaging (n=23; range, 18–40 months; median, 25 months); or (c) by biopsy (n=2; haemangioma and inflammatory lesion). All patients with presumed benign hepatic lesions on CT were followed up without any systemic treatment preoperatively. In the remaining 14 patients, there was no hepatic lesion on preoperative liver MRI and on follow-up postoperative CT and MRI. Among clinicopathological data, the cell types of rectal cancers and preoperative serum carcinoembryonic antigen (CEA) level were recorded.

Imaging acquisition

Abdominopelvic CT examinations was performed on a 40- or 64-section CT system (Philips Brilliance 40; LightSpeed VCT XT, GE Healthcare; Toshiba Aquillion 64) after intravenous injection of a total of 120 ml non-ionic contrast material (iopromide 300 mg iodine/ml; Ultravist 300, Schering, Berlin, Germany) with an automatic injector at a rate of 3–4 ml/s. The CT images of portal venous phase were obtained at 70 s after the initiation of contrast material injection. Section thickness and reconstruction were 2.5 mm and 3 or 5 mm, respectively.

Rectal and liver MRI images were acquired by using a 3 T whole-body system (Intera Achieva 3T; Philips Medical Systems, Best, the Netherlands). For pelvis MRI, a 20-mg dose of scopolamine butylbromide (Buscopan; Boehringer Ingelheim, Ingelheim, Germany) was injected intramuscularly 30 minutes before MRI to reduce colonic motility, and rectal suppository pills were used for rectal cleansing. Approximately 80–100 ml of ultrasound transmission gel (Supersonic, Sungheung, Korea) was also administered using a rectal tube for adequate distention of the rectum and for good contrast between the tumour and rectal lumen.[18–21] First, sagittal localising T2-weighted turbo spin-echo images were obtained and the oblique axial and coronal T2-weighted turbo spin-echo images were obtained orthogonal and parallel to the long axis of the rectal cancer. An axial T1-weighted turbo-field-echo sequence was also performed. All sequences were performed without fat saturation. DWI was obtained in an oblique axial plane using the single-shot echo planar imaging technique with b-

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