



Role of Dedicated Subspecialized Radiologists in Multidisciplinary Team Discussions on Lower Gastrointestinal Tract Cancers

Sun Kyung Jeon^{1,2}, Se Hyung Kim^{1,2,3}, Cheong-il Shin^{1,2}, Jeongin Yoo^{1,2}, Kyu Joo Park⁴, Seung-Bum Ryoo⁴, Ji Won Park⁴, Tae-You Kim⁵, Sae-Won Han⁵, Dae-Won Lee⁵, Eui Kyu Chie⁶, Hyun-Cheol Kang⁶

Departments of ¹Radiology, ⁴Surgery, ⁵Internal Medicine, and ⁶Radiation Oncology, Seoul National University Hospital, Seoul, Korea; ²Department of Radiology, Seoul National University College of Medicine, Seoul, Korea; ³Institution of Radiation Medicine, Seoul National University Medical Research Center, Seoul, Korea

Objective: To determine the impact of dedicated subspecialized radiologists in multidisciplinary team (MDT) discussions on the management of lower gastrointestinal (GI) tract malignancies.

Materials and Methods: We retrospectively analyzed the data of 244 patients (mean age \pm standard deviation, 61.7 ± 11.9 years) referred to MDT discussions 249 times (i.e., 249 cases, as five patients were discussed twice for different issues) for lower GI tract malignancy including colorectal cancer, small bowel cancer, GI stromal tumor, and GI neuroendocrine tumor between April 2018 and June 2021 in a prospective database. Before the MDT discussions, dedicated GI radiologists reviewed all imaging studies again besides routine clinical reading. The referring clinician's initial diagnosis, initial treatment plan, change in radiologic interpretation compared with the initial radiology report, and the MDT's consensus recommendations for treatment were collected and compared. Factors associated with changes in treatment plans and the implementation of MDT decisions were analyzed.

Results: Of the 249 cases, radiologic interpretation was changed in 73 cases (29.3%) after a review by dedicated GI radiologists, with 78.1% (57/73) resulting in changes in the treatment plan. The treatment plan was changed in 92 cases (36.9%), and the rate of change in the treatment plan was significantly higher in cases with changes in radiologic interpretation than in those without (78.1% [57/73] vs. 19.9% [35/176], $p < 0.001$). Follow-up records of patients showed that 91.2% (227/249) of MDT recommendations for treatment were implemented. Multiple logistic regression analysis revealed that the nonsurgical approach (vs. surgical approach) decided through MDT discussion was a significant factor for patients being managed differently than the MDT recommendations (odds ratio, 4.48; $p = 0.017$).

Conclusion: MDT discussion involving additional review of radiology examinations by dedicated GI radiologists resulted in a change in the treatment plan in 36.9% of cases. Changes in treatment plans were significantly associated with changes in radiologic interpretation.

Keywords: Patient care team; Multidisciplinary care team; Disease management; Neoplasms; Radiologists

INTRODUCTION

A multidisciplinary team (MDT) approach is defined by the National Cancer Institute as a "treatment planning

approach in which a number of doctors who are experts in different specialties review and discuss the medical condition and treatment options of patients" [1]. Given that the assessment and management of patients with

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Corresponding author: Se Hyung Kim, MD, Department of Radiology, Seoul National University Hospital, 101 Daehak-ro, Jongno-gu, Seoul 03080, Korea.

• E-mail: shkim7071@gmail.com

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cancer require complex clinical decision-making, the MDT approach has been recommended as the best approach to cancer care to improve diagnosis, treatment planning, and ultimately, patient outcomes [2,3]. The main advantage of the MDT approach is that it allows comprehensive evaluation of patients with cancer from different points of view from team members of different specialties, including surgery, medical oncology, pathology, radiation oncology, and radiology [2].

Previous studies have reported that the predominant benefits of MDT discussions could be achieved in advanced disease, whereas spending time on early or localized disease may be futile [4-6]. Because the MDT approach requires considerable time and resources [7,8], several efforts have been made to process improvements and standardize MDT protocols to increase the efficiency of MDT discussions [9].

Given that the treatment of lower gastrointestinal (GI) tract malignancies is complex, the involvement of neoadjuvant and/or adjuvant chemotherapy (CTx), radiation therapy (RTx), curative surgery, and palliative treatment is increasing; therefore, management of such cases frequently requires multiple specialists [10]. To select proper treatment plans, several factors, including presumptive diagnosis, pathological subtype, cancer stage, and patients' functional status and willingness, should be comprehensively considered [11]. Consequently, coordination among multiple specialists, including colorectal surgeons, medical oncologists, radiation oncologists, hepatobiliary surgeons, GI radiologists, and GI pathologists should be timely and efficient. In this regard, the MDT approach could be helpful for proper and timely management of lower GI tract malignancies. Previous studies have reported the effect of a MDT on survival and improved decision-making processes in patients with lower GI tract malignancies [4,12].

The Royal College of Radiologists published a document that emphasized the importance of radiologists in MDT discussions and summarized the requirements for consulting radiologists to participate in these discussions [13]. Although many hospitals have adopted an MDT approach in the management of lower GI tract malignancies and many radiologists have now contributed to patient management in these discussions, there have been few studies about the role or importance of dedicated GI radiologists in MDT discussions for lower GI tract malignancies.

Our study aimed to determine the impact of dedicated subspecialized GI radiologists in the MDT discussion on the management of lower GI tract malignancies.

MATERIALS AND METHODS

This retrospective study was approved by our Institutional Review Board, and the requirement for written informed consent was waived because of its retrospective nature (IRB No. 2104-109-1212).

Study Population

We retrospectively analyzed data from the prospectively collected lower GI tract malignancy MDT database at our institution. Using a computerized search of the MDT database, we identified consecutive patients who met the eligibility criteria. The inclusion criteria were as follows: 1) lower GI tract malignancy, including colorectal cancer (CRC), small bowel cancer, GI stromal tumor (GIST), and neuroendocrine tumor (NET) and 2) referral for MDT discussions between April 2018 and June 2021. Patients without a follow-up period of ≥ 3 months were excluded because the implementation of the MDT decision was not evaluable. Of 288 MDT discussions (referred to as "cases" hereinafter) involving 283 patients, 39 cases (comprising 39 patients) were excluded owing to lack of an adequate follow-up, leaving 249 cases involving 244 patients (157 male; mean age \pm standard deviation, 61.7 ± 11.9 years) in the analysis. Five patients were discussed twice in MDT meetings for different issues.

As our hospital is a tertiary high-volume center, not all cases of lower GI tract malignancies were referred for MDT discussions at our institution. All cases referred for MDT discussion were advanced diseases, including locally advanced, metastatic, or recurrent diseases for which individual clinicians had difficulty in making decisions by themselves. The cases were referred to determine or change the management plan, and a review of the radiologic interpretation of those cases was requested.

MDT Discussion

At our institution, MDT meetings for lower GI tract malignancy are held weekly, and the participants include colorectal surgeons, medical oncologists, radiation oncologists, radiologists, oncological nurse coordinators, gastroenterologists, and hepatobiliary surgeons, as required. All cases presented to the MDT are shared with the MDT participants in advance, along with preconference diagnoses, treatment plans, and discussion points. Before the MDT discussions, one of the two dedicated GI radiologists (with 17 and 14 years of experience in GI imaging, respectively),

who are primarily dedicated to reading and studying the imaging of GI tract disorders, review all imaging studies again besides routine clinical reading, including CT, MRI, and/or PET/CT or PET/MRI studies. When a thoracic lesion becomes an important discussion point, chest CT scans are reviewed by the dedicated GI radiologists. After clinical presentation and a brief review by clinicians, the MDT radiologist is invited to comment on the radiologic imaging findings. After deliberation over all other available information, the MDT radiologist is often able to provide further input and clarification in the interpretation of the radiologic images, either voluntarily or upon direct questioning from team members. After the discussion of each individual patient, a consensus is reached on the treatment plan or further diagnostic workup. Thereafter, the MDT consensus recommendation for the treatment plan or further diagnostic workup is recorded in the MDT database.

Data Collection

Using a computerized search of medical records and the MDT database of our institution, specific information was collected on the characteristics of patients and diseases, including demographic data, pathologic diagnosis, disease staging or extent, metastasis or recurrence site, and previous treatments. Referring to the clinicians' initial diagnoses, the proposed treatment plans decided by referring clinicians were collected. The initial radiologic interpretation, which was reported by various radiologists, including dedicated GI radiologists, general abdominal radiologists, or thoracic radiologists, was also collected.

Any changes in radiologic interpretation, including changes in disease extent (changes in local tumor extent or detection of additional distant metastasis), and changes in the characterization of lesions through dedicated GI radiologists' comments during the MDT meeting were also recorded. Any changes in treatment plans during the MDT meeting, such as from nonsurgical to surgical treatment or vice versa, changes in nonsurgical treatment methods, and additional diagnostic workup were also recorded. Differences between the referring clinician's plans and the MDT's consensus recommendations were compared. In addition, we followed a cohort of patients with MDT to assess the implementation of MDT recommendations. Decision implementation, defined as following the MDT recommendations, was assessed at least 3 months after the MDT meeting. If multiple treatment options were proposed in the MDT discussion, the MDT decision was made following

the first treatment option.

In 191 cases with a reference standard determined pathologically ($n = 64$) or by follow-up imaging ($n = 127$), the outcome of radiologic interpretation was evaluated for lesions that were a discussion point in the MDT meeting. Differences between the initial radiologic interpretation and the radiologic interpretation determined by the MDT radiologists were compared. The extent of the local tumor was confirmed by surgical and pathological reports. Malignant lesions were confirmed pathologically through biopsy, surgery, or disease progression on follow-up imaging and hypermetabolism on ^{18}F -fluorodeoxyglucose PET/CT. Benign lesions were confirmed by stability or spontaneous regression on at least 1 year of follow-up imaging or pathologically through biopsy.

Statistical Analysis

Data analysis was performed for each case. The rate of change in treatment plan according to age (≥ 65 years vs. < 65 years), sex (male vs. female), disease status (newly diagnosed vs. recurrent disease), and change in radiologic interpretation was compared using the chi-square test. Univariable and multivariable logistic regression analyses were performed to identify factors significantly associated with the implementation of MDT decisions. Variables that showed a significant association ($p < 0.10$) in the univariable analysis were entered into the multivariable analysis, and backward stepwise elimination was performed. All statistical analyses were performed using SPSS version 25.0 (IBM Corp.). Statistical significance was set at $p < 0.05$.

RESULTS

Patients

The characteristics of the study population are summarized in Table 1. Of the 249 cases, most were submitted by colorectal surgeons ($n = 175$, 70.3%), followed by medical oncologists ($n = 59$, 23.7%), and radiation oncologists ($n = 15$, 6.0%). The major pathological diagnoses were CRC ($n = 229$, 92.0%), and other diagnoses included small bowel cancer ($n = 4$, 1.6%), GIST ($n = 10$, 4.0%), and NET ($n = 6$, 2.4%). Of the patients with CRC, 47 (18.9%) had newly diagnosed CRC and 182 (73.1%) had recurrent CRC.

Changes in Radiologic Interpretation

Changes in radiologic interpretation are summarized in

Table 1. Study Population Characteristics

Patients (n = 244)	
Age, mean year ± standard deviation	61.7 ± 11.9
Sex	
Male	157 (64.3)
Female	87 (35.7)
Cases (n = 249)	
Referral department	
Surgery	175 (70.3)
Medical oncology	59 (23.7)
Radiation oncology	15 (6.0)
Final pathologic diagnosis	
CRC	229 (92.0)
Newly diagnosed CRC	
Locally advanced	8 (3.2)
Metastatic	39 (15.7)
Recurrent CRC	182 (73.1)
Small bowel cancer	4 (1.6)
Gastrointestinal stromal tumor	10 (4.0)
Neuroendocrine tumor	6 (2.4)

Data are number of patients with percentages in parentheses unless specified otherwise. CRC = colorectal cancer

Table 2 for all cases and in Supplementary Tables 1, 2, and 3 for cases with CRC, GIST, and NET, respectively. Of the 249 cases, radiologic interpretation changed in 73 cases (29.3%) after review by dedicated GI radiologists. Of the 73 cases, the initial reading was performed by dedicated GI radiologists in 8.2% (6/73) of cases, whereas general abdominal radiologists performed the initial reading in 91.8% (67/73) of cases ($p = 0.002$).

In 24 cases (32.8%), the disease extent changed, including changes in local tumor extent ($n = 12$, 16.4%) and detection of distant metastasis ($n = 12$, 16.4%). In terms of local tumor extent, dedicated GI radiologists tended to further describe tumor invasion of adjacent organs, including the prostate gland, seminal vesicle, uterus, small bowel, or major vessels, and in all cases, there were changes in the treatment plan, including changes in the surgical extent or additional local treatment including RTx. Additional detection of distant metastasis included metastasis to the liver ($n = 2$), bone ($n = 1$), lung ($n = 3$), lymph nodes (LNs) ($n = 2$; obturator or aortocaval), and

Table 2. Changes in Radiologic Interpretation

	Total (n = 73)	With Changes in Management Plan (n = 57)	Without Changes in Management Plan (n = 16)
Change in disease extent			
Local tumor extent	12 (16.4)	12 (21.1)	0 (0)
Detection of distant metastasis	12 (16.4)	10 (17.5)	2 (12.5)
Change in lesion characterization			
Malignant to benign	22 (30.1)	19 (33.3)	3 (18.8)
Benign to malignant	6 (8.2)	4 (7.0)	2 (12.5)
Others*	21 (28.8)	12 (21.1)	9 (56.3)

Data are number of patients with percentages in parentheses. *Others include the change in diagnosis of malignant disease including changes of diagnosis from primary malignancy to metastasis ($n = 3$), from metastasis to primary malignancy ($n = 10$), and change in differential diagnosis of primary malignancy ($n = 8$).

Table 3. Changes in Treatment Plans

	Total (n = 92)	With Changes in Radiologic Interpretation (n = 57)	Without Changes in Radiologic Interpretation (n = 35)
Change in surgical extent	7 (7.6)	7 (12.3)	0 (0)
Surgical to nonsurgical treatment	17 (18.5)	8 (14.0)	9 (25.7)
CTx ± with or without RTx	13 (14.1)	8 (14.0)	5 (14.3)
RFA or SABR	4 (4.3)	0 (0)	4 (11.4)
Nonsurgical to surgical treatment to surgery	23 (25.0)	14 (24.6)	9 (25.7)
Change in nonsurgical treatment method	34 (37.0)	18 (31.6)	16 (45.7)
CTx to local treatment (RFA or SABR)	11 (12.0)	4 (7.0)	7 (20.0)
Local treatment (RFA or SABR) to CTx	1 (1.1)	0 (0)	1 (2.9)
Addition of local treatment (RFA or SABR) to CTx	8 (8.7)	4 (7.0)	4 (11.4)
Additional diagnostic work-up	14 (15.2)	10 (17.5)	4 (11.4)
Observation	11 (12.0)	10 (17.5)	1 (2.9)

Data are number of patients with percentages in parentheses. CTx = chemotherapy, RFA = radiofrequency ablation, RTx = radiation therapy, SABR = stereotactic ablative radiotherapy

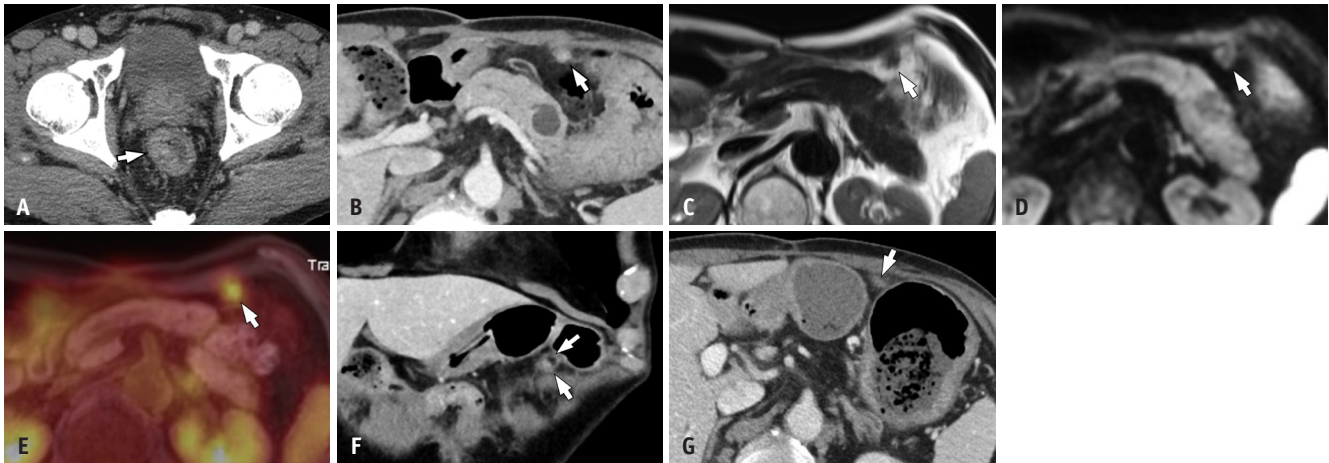


Fig. 1. A 79-year-old male with rectal cancer.

A. Initial contrast-enhanced CT shows eccentric enhancing wall thickening with perirectal fat infiltration in the distal rectum (arrow). Incidentally, a lateral spreading tumor was also found in the transverse colon during preoperative colonoscopy (not shown). After concurrent chemoradiation therapy, subsequent ultra-low anterior resection and left hemicolectomy were performed, and the patient was finally diagnosed with ypT2N1c-stage rectal cancer and a low-grade tubular adenoma in the transverse colon. **B.** On a follow-up contrast-enhanced CT taken 15 months after the surgery, an 8-mm enhancing nodule (arrow) was noted at the greater omentum. **C-E.** On fully integrated ^{18}F -FDG PET/MRI, the peritoneal lesion (arrows) shows intermediate-high signal intensity on a T2-weighted image (**C**), diffusion restriction on a diffusion-weighted image (**D**), and hot uptake on an FDG PET image (**E**). The initial radiologic diagnosis was peritoneal seeding. **F.** During a thorough review of CT images by a dedicated gastrointestinal radiologist prior to the MDT discussion, intralésional fat density and perilesional infiltration (arrows) were found; therefore, the radiologic diagnosis for the lesion was changed to fat necrosis. After MDT discussion, the patient's management plan was changed from palliative chemotherapy to observation. **G.** A follow-up CT image obtained 5 months later reveals that the lesion (arrow) had shrunk in size without any treatment. FDG = fluorodeoxyglucose, MDT = multidisciplinary team

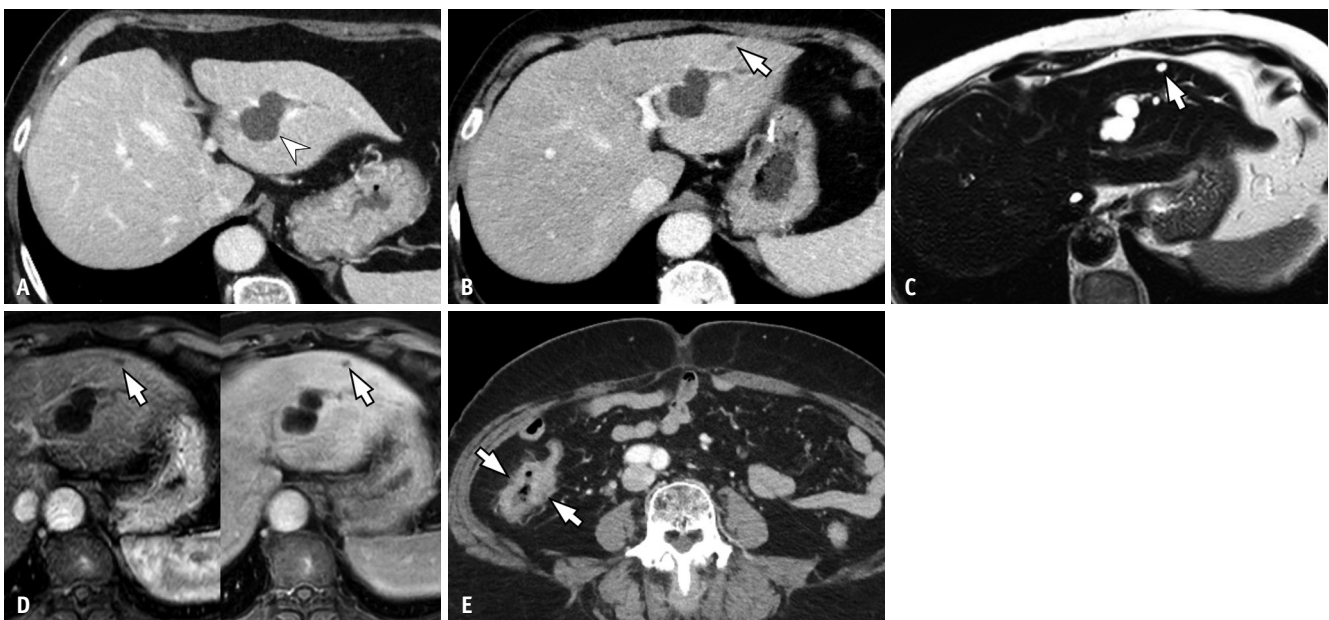


Fig. 2. A 71-year-old female with cecal cancer.

A, B. Initial contrast-enhanced CT depicted an enhancing wall thickening with pericolic fat infiltration at the cecum (arrowhead on **A**), with no evidence of a focal lesion except a simple cyst in the liver (arrow on **B**). The patient underwent right hemicolectomy and was finally diagnosed with T3bN2b-stage cecal adenocarcinoma. **C.** On a follow-up CT obtained 5 months after surgery, a 7-mm low attenuated lesion (arrow) was newly found in segment III of the liver. The initial radiologic diagnosis was liver metastasis. After an image review prior to a MDT meeting, a dedicated gastrointestinal radiologist suggested the possibility of a benign lesion, such as a hepatic cyst because of the low HU value (25 HU). During MDT meeting, the radiologist recommended liver MRI to precisely characterize the lesion. **D.** On axial T2-weighted MRI of the liver, the lesion (arrows) shows bright high signal intensity suggesting a benign lesion such as a hepatic hemangioma or cyst. **E.** On contrast-enhanced T1-weighted MRI images obtained in the arterial (left) and portal (right) phases, no enhancement is observed in the lesion (arrows). Therefore, a hepatic cyst was diagnosed. Accordingly, the patient's management plan was changed from palliative chemotherapy to observation. HU = Hounsfield unit, MDT = multidisciplinary team

peritoneal seeding nodules ($n = 4$). In 49 cases (67.1%), lesion characterization changed. The most common changes in lesion characterization were changes from malignant to benign lesions ($n = 22$, 30.1%), including liver metastasis ($n = 6$) to benign lesions including peliosis hepatis, hemangiomas, or cysts; LN metastasis ($n = 6$) to reactive LNs or tuberculous lymphadenitis; perivascular tumor infiltration ($n = 5$) to inflammation including postoperative change or immunoglobulin G4-related disease; and peritoneal seeding ($n = 4$) to fat necrosis or benign inflammatory nodules. Changes from benign to malignant lesions ($n = 6$, 8.2%) included changes from inflammatory lesions to metastasis in the lungs ($n = 3$), liver ($n = 2$), and presacral area ($n = 1$).

In 191 cases with a reference standard determined pathologically ($n = 64$) or with follow-up imaging ($n = 127$), the diagnostic accuracy of radiologic interpretation determined by the MDT radiologists increased compared with the initial radiologic interpretation (91.1% [174/191] vs. 84.8% [162/191], $p < 0.001$).

Changes in Treatment Plan

Changes in treatment plans are summarized in Table 3 for all cases and Supplementary Tables 4 and 5 for cases with CRC and other cancers, including small bowel cancer, GIST, and NET. Of the 249 patients, the treatment plan was changed according to the MDT recommendations in 92 patients (36.9%). The rate of change in treatment plan was significantly different depending on the changes in radiologic interpretation (patients with changes in radiologic interpretation vs. patients without changes in radiologic interpretation, 78.1% [57/73] vs. 19.9% [35/176], $p < 0.001$). In all cases in which both radiologic interpretation and treatment plans were changed ($n = 57$), the change in treatment plan was due to the change in radiologic interpretation. However, other factors such as age (≥ 65 years vs. < 65 years: 36.3% [37/102] vs. 37.4% [55/147]; $p = 0.855$), sex (male vs. female: 38.9% [63/162] vs. 33.3% [29/87]; $p = 0.387$), and disease status (newly diagnosed disease vs. recurrent disease: 42.6% [26/61] vs. 35.1% [66/188]; $p = 0.291$) did not show any significant differences.

The most common changes in treatment plan were

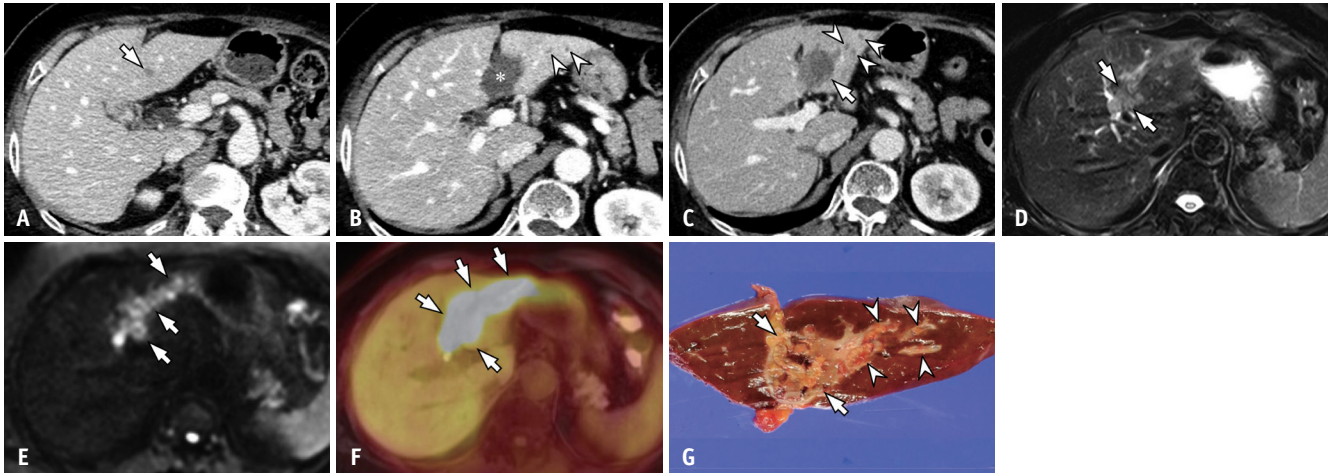


Fig. 3. A 74-year-old female with ascending colon cancer. The patient had undergone right hemicolectomy 2 years previously. **A.** Follow-up contrast-enhanced CT after surgery shows a 7-mm low attenuated lesion (arrow) at segment III of the liver. The lesion was confirmed as liver metastasis through ultrasound-guided percutaneous biopsy. For this lesion, RFA was performed. **B.** A 3-cm dark attenuated RFA defect (*) is observed on follow-up CT after RFA. Note mild dilatation of the adjacent BDs (arrowheads) due to RFA-related biliary stricture. **C.** On follow-up CT obtained at 9 months after RFA, a low attenuated lesion (arrow) with adjacent BD dilatation (arrowheads) is still noted. At that time, a radiologist reported this lesion as an RFA defect with secondary BD dilatation. However, after a thorough image review by a dedicated gastrointestinal radiologist during a MDT discussion, the possibility of tumor recurrence with intraductal tumor extension was suggested because the attenuation within the treated lesion was increased compared to that in the previous CT, and slight progression of ductal dilatation was noted. Therefore, further imaging was recommended with PET/MRI. **D-F.** On ^{18}F -fluorodeoxyglucose PET/MRI, the lesion (arrows) shows intermediate high signal intensity on T2-weighted imaging (**D**), restricted diffusion on diffusion-weighted imaging (**E**), and strongly hot uptake on fusion PET/MRI (**F**). Tumor recurrence with intraductal tumor extension was strongly suggested during an MDT discussion. Therefore, the patient's management plan was changed from observation to surgery. The patient underwent left hemihepatectomy. **G.** Photo of a gross specimen shows a 5.5-cm yellowish mass (arrows) at segment III of the liver and intraductal soft tissue lesions (arrowheads). Microscopic examination finally confirmed liver metastasis with intraductal tumor extension. BD = bile duct, MDT = multidisciplinary team, RFA = radiofrequency ablation

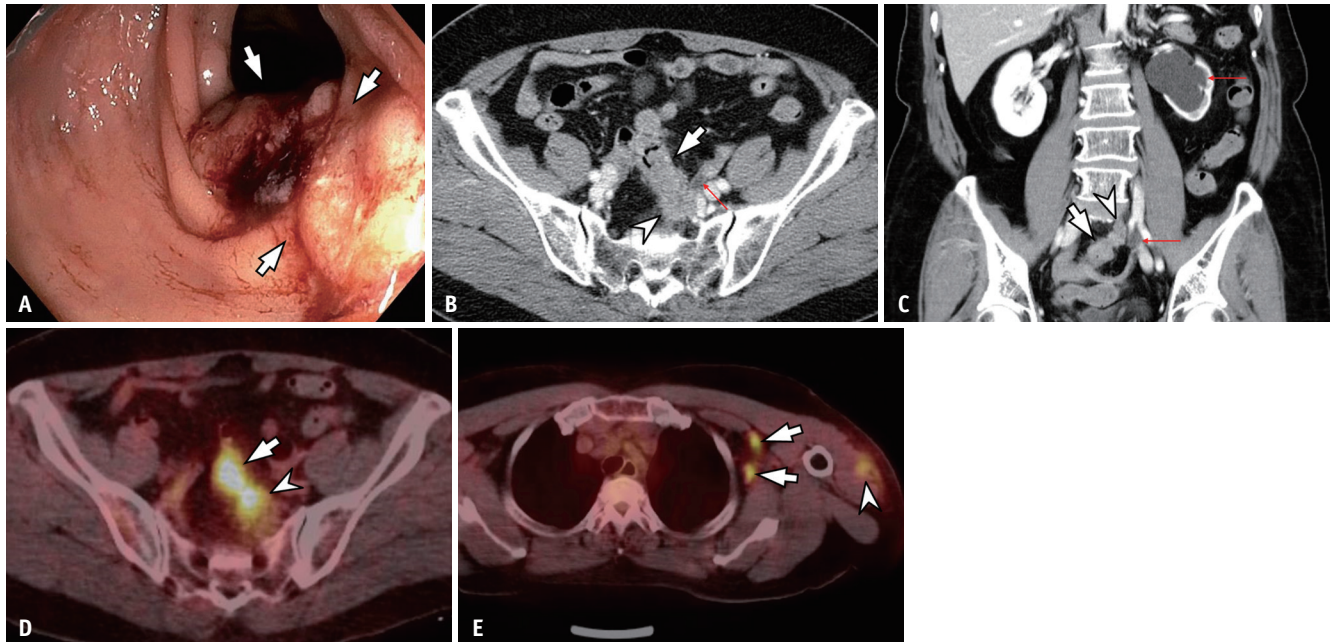


Fig. 4. A 73-year-old female with rectosigmoid junction cancer.

A. A 5-cm ulceroinfiltrative mass (arrows) is seen at the rectosigmoid junction on a colonoscopic image. Colonoscopic biopsy confirmed well-differentiated adenocarcinoma (not shown). **B, C.** Axial (**B**) and coronal (**C**) contrast-enhanced CT images show well-enhanced wall thickening in the rectosigmoid junction colon (white arrows) and adjacent pericolic LN enlargement (arrowheads). The left distal ureter is encased by the enlarged LN, leading to left hydronephrosis (red arrows). **D.** On a ^{18}F -FDG PET/CT image, colon wall thickening (arrow) and an adjacent enlarged LN (arrowhead) show strong FDG uptake suggesting rectosigmoid junction cancer with a pericolic metastatic LN. **E.** On an FDG PET/CT image at the thoracic level, a few FDG-avid LNs (arrows) are observed at the left axillary area. The nuclear medicine doctor interpreted these LNs as metastatic LNs. Therefore, palliative chemotherapy was planned. However, after a thorough image review by a dedicated gastrointestinal radiologist during a MDT discussion, the radiologist circumspectively noticed that there was an FDG-avid lesion at the left deltoid area (arrowhead) and therefore suggested the possibility of reactive FDG uptake after COVID-19 vaccination. After an MDT conference, clinicians confirmed that the patient received a COVID-19 vaccination 18 days before FDG PET imaging. Therefore, the management plan for the patient was changed to radical surgery. COVID = coronavirus disease, FDG = flurodeoxyglucose, LN = lymph node, MDT = multidisciplinary team

changes in nonsurgical treatment methods (37.0% [34/92]), followed by changes from nonsurgical to surgical treatment (25.0% [23/92]) and surgical to nonsurgical treatment (18.5% [17/92]) (Table 3). Of the changes in nonsurgical treatment ($n = 34$), the most common involved additional diagnostic workup ($n = 14$; MRI [$n = 3$], PET/CT or PET/MRI [$n = 6$], or biopsy [$n = 5$]) for further characterization of lesions, followed by changes from CTx to local treatment, including radiofrequency ablation (RFA) or stereotactic ablative radiotherapy (SABR) ($n = 11$) after the possibility of local treatment was identified in the MDT discussion. Of the 17 patients whose treatment was changed from surgical to nonsurgical, CTx with or without RTx was selected in 13 patients because of unresectable lesions. For the remaining four patients, either RFA or SABR was considered because these lesions were located in anatomically unfit areas for surgery. Representative examples are shown in Figures 1-4.

Implementation of MDT Decision

Follow-up records of patients showed that 91.2%

(227/249) of MDT decisions regarding treatment plans were ultimately implemented for patient care, whereas 8.8% (22/249) of MDT decisions were not implemented. Multivariable logistic regression analysis showed that the nonsurgical approach (vs. surgical approach) decided through MDT discussion was a significant factor for patients being managed differently from the MDT decisions (odds ratio, 4.48; 95% confidence interval, 1.30–15.44; $p = 0.017$). Changes in the treatment plan or radiologic interpretation were not significant factors for compliance with the MDT decisions (Table 4).

DISCUSSION

Our study revealed that secondary review of imaging studies by dedicated GI radiologists during MDT meetings resulted in changes in radiologic interpretation in almost 30% (73/249) of lower GI tract cases, with a considerable proportion (78.1% [57/73]) of patients having changes in their treatment plans. In addition, changes in treatment

Table 4. Factors for Discordance between MDT Decision and Implementation of Treatment Plan

	Concordance between MDT Decision and Final Treatment*		Univariable Analysis		Multivariable Analysis	
	Concordant (n = 227)	Discordant (n = 22)	OR (95% CI)	P	OR (95% CI)	P
Sex						
Male (n = 162)	149 (92.0)	13 (8.0)				
Female (n = 87)	78 (89.7)	9 (10.3)	1.05 (0.45, 2.49)	0.907		
Age, years						
< 65 (n = 147)	134 (91.2)	13 (8.8)				
≥ 65 (n = 102)	93 (91.2)	9 (8.8)	0.96 (0.41, 2.22)	0.918		
Diagnosis						
CRC (n = 229)	207 (90.4)	22 (9.6)	NA			
Non-CRC (n = 20)	20 (100)	0 (0)				
Status of disease						
Newly diagnosed disease (n = 61)	59 (96.7)	2 (3.3)				
Recurred disease (n = 188)	168 (89.4)	20 (10.6)	4.11 (0.94, 17.98)	0.060	2.69 (0.59, 12.33)	0.203
MDT-decided treatment plan						
Surgical approach (n = 88)	85 (96.6)	3 (3.4)				
Nonsurgical approach (n = 161)	142 (88.2)	19 (11.8)	4.48 (1.30, 15.44)	0.017 [†]	4.48 (1.30, 15.44)	0.017 [†]
Change in treatment plan						
No change (n = 157)	142 (90.4)	15 (9.6)				
Change (n = 92)	85 (92.4)	7 (7.6)	0.78 (0.32, 1.90)	0.590		
Change in radiologic findings						
No change (n = 176)	159 (90.3)	17 (9.7)				
Change (n = 73)	68 (93.2)	5 (6.8)	0.57 (0.21, 1.59)	0.286		

*Data are number of patients with percentages in parentheses, [†]Statistical significance. CI = confidence interval, CRC = colorectal cancer, MDT = multidisciplinary team, OR = odds ratio

plans occurred in 36.9% (92/249) of patients through MDT discussions, and the rate of change in treatment plans was significantly higher in patients with changes in radiologic interpretation than in those without changes in radiologic interpretation (78.1% [57/73] vs. 19.9% [35/176], $p < 0.001$). We believe that this observation highlights the important role of dedicated GI radiologists in the MDT discussions. Moreover, treatment plans that changed according to the MDT recommendations were well implemented.

In our study, we found that a second review of imaging studies by dedicated GI radiologists resulted in changes in radiologic interpretation in almost 30% (73/249) of our patients and, consequently, had a significant impact on changes in treatment plans, along with integrated and comprehensive communication with clinicians. A previous study also showed changes in radiological interpretation after review by dedicated GI radiologists in a similar proportion of patients [14]. Dedicated GI radiologists tended to detect more unreported lesions on initial

radiologic reports or make a change in the characterization of lesions from malignancy to benignity or vice versa, which resulted in a change in treatment plans. Notably, the diagnostic accuracy of radiologic interpretation increased after review of imaging studies by dedicated GI radiologists. Given that the interpretation of radiologic imaging by dedicated radiologists is more accurate than that by radiologists without a subspecialty [15-17], dedicated GI radiologists could play a critical role in the radiologic diagnosis and management in the MDT approach for lower GI tract malignancies. Our study results demonstrated that MDT discussions changed the treatment plan in 36.9% (92/249) of the patients. A change in radiologic interpretation by a dedicated GI radiologist was a significant factor affecting changes in the treatment plan. This result is in agreement with those of previous studies, in which the percentage of patients who underwent changes in the treatment plan after MDT discussions ranged from 4.5% to 52.0%, and alterations in patient treatment plans frequently occurred following changes in radiologic diagnoses after a second

review of imaging data, highlighting the important role of radiologists in the MDT approach [14,18-20].

Implementation rates can be an important indicator of the impact of the MDT. In our study, the implementation rate was 91.2% (227/249). This high implementation rate suggests that our MDT meeting had a beneficial influence on making appropriate decisions in complicated cases of lower GI tract malignancies. Few studies have investigated MDT decision implementation. In previous studies, the rate of MDT decision implementation ranged from 87.3% to 93.6% [6,21]. In our study, the discordance in the implementation of MDT recommendations mainly occurred when nonsurgical treatment was suggested through MDT discussion (odds ratio, 4.48; $p = 0.017$). This can be explained by the fact that the most common reason for not complying with MDT recommendations was patient choice and that patients may not follow nonsurgical treatment because they consider it as having an unclear treatment effect or that it is not a beneficial option for survival, in contrast to surgical treatment [14]. In addition, considering the high rate of adverse effects of CTx, a representative nonsurgical treatment option, patients may refuse such treatment, resulting in a low implementation rate.

Our study has several limitations. First, despite prospective data collection, our study was retrospective. In addition, our study had a heterogeneous patient cohort, as patient selection was performed at the discretion of individual clinicians. Therefore, this may have led to potential selection bias by including more complicated and controversial cases. Because of this inherent limitation, our study results cannot be directly applied to all hospitals. However, we believe that our study results could provide evidence regarding the effectiveness of the MDT approach as well as the role of dedicated GI radiologists in MDT discussions in high-volume and highly specialized cancer centers. Second, we did not analyze the patients' clinical outcomes, such as overall survival. Therefore, further studies targeting patients' clinical outcomes are warranted to assess whether the MDT approach and dedicated GI radiologists contribute to a better oncologic prognosis. Third, when evaluating the implementation of MDT decisions, patient factors, such as socioeconomic status or Eastern Cooperative Oncology Group performance status, were not analyzed due to insufficient data.

In conclusion, MDT discussion involving additional review of radiology examinations by dedicated GI radiologists resulted in a change in the treatment plan in 36.5% of

cases. This change was significantly associated with changes in radiologic interpretation. A second-opinion review of radiology examinations by dedicated GI radiologists as part of an MDT can be helpful for decision-making regarding the management of patients with lower GI tract malignancies.

Supplement

The Supplement is available with this article at <https://doi.org/10.3348/kjr.2021.0680>.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Se Hyung Kim. Data curation: all authors. Formal analysis: Sun Kyung Jeon, Se Hyung Kim. Funding acquisition: Se Hyung Kim. Writing—original draft: Sun Kyung Jeon. Writing—review & editing: Se Hyung Kim.

ORCID iDs

Sun Kyung Jeon

<https://orcid.org/0000-0002-8991-3986>

Se Hyung Kim

<https://orcid.org/0000-0001-8664-0356>

Cheong-il Shin

<https://orcid.org/0000-0002-5457-4523>

Jeongin Yoo

<https://orcid.org/0000-0002-3267-2544>

Kyu Joo Park

<https://orcid.org/0000-0002-9134-7426>

Seung-Bum Ryoo

<https://orcid.org/0000-0001-6407-0444>

Ji Won Park

<https://orcid.org/0000-0003-0046-8175>

Tae-You Kim

<https://orcid.org/0000-0001-5500-0794>

Sae-Won Han

<https://orcid.org/0000-0003-3275-431X>

Dae-Won Lee

<https://orcid.org/0000-0001-7133-6669>

Eui Kyu Chie

<https://orcid.org/0000-0003-2027-7472>

Hyun-Cheol Kang

<https://orcid.org/0000-0002-8981-6123>

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