Review

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Preoperative Diagnostic Imaging of Rectal Cancer for Determination of Therapeutic Strategy: Diagnostic Criteria and Current Status of Diagnostic Imaging

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The goal of this review is to explain the objectives and practical points of preoperative diagnostic imaging performed to determine a therapeutic strategy for rectal cancer. Treatment for rectal cancer differs depending on the disease stage, which is determined based on the depth of invasion, grade of lymph node metastasis, and the presence or absence of distant and peritoneal metastases. These factors can be evaluated using techniques such as enema, colonoscopy, ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI) and ^{18}F-fluorodeoxyglucose-positron emission tomography (FDG-PET). In particularly, diagnosis of T1b cancer, which may be accompanied by lymph node metastasis, is important in determining the therapeutic strategy for early-stage cancer. Indications for advanced cancer include sphincter-preserving surgery, combined resection of adjacent organs, surgery ensuring the circumferential resection margin (CRM), and lateral lymph node dissection (LLD). Optimal treatment should be sufficient but not excessively invasive and stressful, and planning of such treatment requires accurate disease evaluation based on a clear understanding of the accuracy and limitations of diagnostic imaging.

Key Words: preoperative diagnostic imaging, rectal cancer, colonoscopy, magnetic resonance imaging (MRI), lateral lymph node dissection (LLD)

Introduction

The therapeutic strategy for rectal cancer differs depending on the disease stage. Surgical resection is likely to be most effective, including endoscopic excision, such as endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD); local resection, such as transanal local resection and transanal endoscopic microsurgery (TEM); and combinations of sphincter-preserving surgery, abdominoperineal resection of the rectum, and total pelvic exenteration combined with resection of adjacent organs. Surgical procedures attaching greater importance to functional preservation, such as autonomic nerve preservation, are increasingly common, reflecting the various dysfunctions that accompany extended lymph node dissection prioritizing curability. Low-invasive laparoscopic surgery has also recently become more widely performed.

Adjuvant therapy such as radiotherapy and chemotherapy is administered in addition to surgical resection, with the aim of improvement of therapeutic outcomes. Preoperative chemoradiotherapy (CRT) is standard treatment for rectal cancer in western countries. However, there is insufficient evidence in support of its efficacy and safety in Japan, and these issues need to be evaluated in properly designed clinical trials. National Comprehesive Cancer Network (NCCN) guidelines show that the indication of preoperative chemoradiotherapy is ≥ T3 or N(+) cases[1].

An ideal treatment provides a maximum therapeutic effect without excess stress. To achieve this outcome, an accurate diagnosis of the disease stage is necessary to determine an optimum therapeutic strategy. The disease stage of rectal cancer is judged based on the depth of invasion, grade of lymph node metastasis, and presence or absence of distant and peritoneal metastases. Diagnostic imaging is required to evaluate these factors. In this review, we discuss the objectives and practical points of preoperative diagnostic imaging of rectal cancer performed for determination of a therapeutic strategy.

1. Significance and objectives of diagnostic imaging in determining therapeutic strategy

The therapeutic strategy for rectal cancer is based on a physical rectal examination, preoperative imaging, and intraoperative findings. However, intraoperative local evaluation may be limited when the main tumor is located at a level lower than the peritoneal reflection, and it is impossible to make a diagnosis based on palpation in laparoscopic surgery. A decision on the therapeutic strategy may be based on intraoperative findings in some cases, but recent advances in diagnostic imaging have facilitated accurate preoperative evaluation that now permits determination of the therapeutic approach in many cases.

Imaging may be performed using enema, colonoscopy, ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET). The European Society for Medical Oncology (ESMO) Consensus Guidelines specify MRI as the first choice for evaluation of the location, T stage, sphincter infiltration, mesorectal fascia (MRF) involvement, and N stage in evaluation of all stage rectal cancer except the depth of invasion of T1 stage, thus preoperative evaluation using MRI is particularly useful in most cases[2].

Preoperative evaluation is used to determine the therapeutic strategy for early-stage rectal cancer in a case with diagnosis of T1b cancer (deep submucosal (SM) invasion), which may be accompanied by lymph node metastasis, and for advanced cancer. These cases have a potential indication for sphincter-preserving surgery, combined resection of adjacent organs, surgery ensuring the circumferential resection margin (CRM), and lateral lymph node dissection (LLD).

2. Diagnostic imaging for determination of therapeutic strategy

1) Diagnosis of T1b cancer

The purpose of diagnosis of an early-stage tumor up to T1 is to distinguish whether the tumor is stage Tis or T1a (slight SM invasion), which is unlikely to be accompanied by lymph node metastasis; or T1b, which is likely to be accompanied by metastasis. Such tumors are evaluated using enema, colonoscopy, magnifying endoscopy, and endoscopic ultrasonography (EUS). In normal observation by colonoscopy, extensibility is evaluated by air insufflation, and the presence or absence of erosion, ulceration, deformation, and sclerosis is observed. T1 b cancer is suspected upon observation of an obvious deep ulcer, an expanding appearance, a submucosal tumor rising from a protruding lesion, poor extension of the normal mucosa around the lesion, table-shaped elevation, or concentration of mucosal folds. About 70–80% of cases of T1b cancer can be definitely diagnosed by normal observation[3].

In magnifying endoscopy, the lesion is diagnosed based on the morphology of the ductal opening on the tumor mucosal surface (pit pattern)[4)5)]. Pit pattern-based diagnosis has mainly been established by the Project Group on 'Elucidation of the diagnostic significance of pit patterns of colorectal tumorous lesions' (Kudo Group), supported by a Health and Labour Science Research Grant for Cancer Research[6]. Of the pit patterns observed on magnifying endoscopy, VN-type and markedly irregular VI-type pit patterns are considered to be T1b cancer, and a mildly irregular VI-type pit pattern is considered to be Tis or T1a cancer[6] (Fig. 1a, b).

Diagnosis using narrow-band imaging (NBI) can also be performed[6]. Differentiation of cancers based on classification using NBI is not superior to the diagnostic accuracy of pit patterns, but T1b cancer is suspected upon observation of an irregular pattern, in which disrupted blood vessels with irregularly sized openings and strong curvature are observed in the region consistent with the infiltrated region;

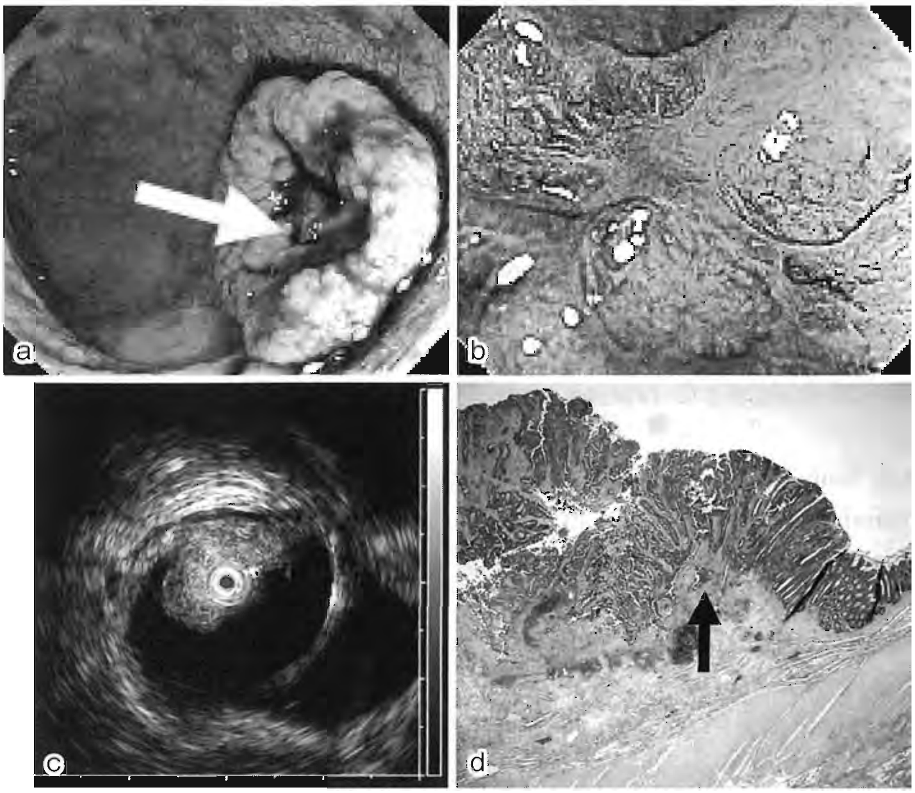


Fig. 1 Case of T1b (deep SM invasion) cancer
a, b, V_N-type pit pattern observed in magnifying endoscopy (⇨); c, Tumor rupturing the 3rd layer, but not changing the 4th layer in EUS; d. The pathological finding was T1b (deep SM invasion) (⇨).

or a sparse pattern, in which blood vessels with irregular openings and distribution are sparsely present in concave regions[6].

An ultrasonic probe (USP) insertable through the hole of endoscopic forceps is used for diagnosis of the depth of invasion using EUS. A USP is superior for this purpose because it can be operated while directly observing the lesion. The normal large intestinal wall is visualized as 5 layers, with the 3rd high-echoic and 4th low-echoic layers corresponding to the SM and muscularis propria (MP) layers, respectively. The depth of invasion is judged based on the deepest layer in which the wall layer structure is narrowed and ruptured by the low-echoic tumor (Fig. 1c, d).

Judgment of the grade of SM invasion can be difficult due to poor visualization of the muscularis mucosa in measurement of the invasion distance. Kobayashi et al[7] proposed that tumors causing mild narrowing of the upper margin of the 3rd layer should be judged as slight SM cancers; and those clearly narrowing or rupturing the 3rd layer, but not changing the 4th and lower layers, as massive SM cancers. Differential diagnosis between Tis or T1a and T1b cancer has been found to be 80–94% for visualizable lesions[7].

2) Evaluation of indication for sphincter-preserving surgery

Advancement on the anal side is evaluated by rectal examination, enema, and colonoscopy. Intersphincteric resection (ISR) is indicated based on the relationship between the lower margin of the tumor and the dentate line[8,9]. When the lower margin of the tumor is present on or directly above the dentate line, total ISR is indicated, in which dissection is applied in the conjoined longitudinal muscle, conserving the external sphincter muscle of the anus, and the internal sphincter muscle of the anus is entirely excised. When the lower margin of the tumor is present within 1 cm oral to the dentate line, subtotal ISR is indicated, in which the internal sphincter muscle of the anus is partially conserved, unlike in total ISR. When the lower margin of the tumor is more than 1 cm oral to the dentate line between the anal canal and its upper margin, partial ISR is indicated, in which the internal sphincter muscle of the anus is partially resected. Partial ISR includes a part of coloanal anastomosis performed before ISR.

Invasion in the levator ani muscle and sphincter muscle is mainly investigated using CT and MRI. ISR is indicated for a T3 stage tumor on the oral side of the anal canal, but can only be applied up to the T2 stage for a tumor within the anal canal. Abdominoperineal resection of the rectum is indicated for a case with invasion in the levator ani muscle. When the tumor is present within the anal canal, the grade of tumor invasion in the intestinal wall and internal sphincter muscle of the anus is evaluated. MRI is useful for this purpose as a highly specific diagnostic method with superior contrast resolution in soft tissue, which allows the anatomy of the rectum and region around the anal canal to be easily identified[10]. In addition, the signal-to-noise ratio (SNR) of recently developed 3T MRI is higher than that of 1.5T MRI, and images with higher spatial resolution can be acquired[11]. The conjoined longitudinal muscle present between the internal and external sphincter muscles of the anus, which is the division point in ISR, is visualized as a high-intensity ring on MRI[12].

3) Evaluation of the requirement for combined resection of adjacent organs

The rectum is located close to surrounding organs on the anterior wall side, including the urinary bladder, seminal vesicles, prostate, uterus, and vagina. For bulky tumors, it is important to evaluate invasion of these surrounding organs. A prognosis equivalent to that of cases without invasion can be expected for T4b cases accompanied by invasion of the surrounding organs by securing the surgical margin and acquiring a negative CRM[13]. For cases with invasion of adjacent organs, partial or total resection of the invaded organ is used corresponding to the grade of invasion.

Preoperative evaluation of adjacent organ invasion is performed using transrectal US (TRUS), CT, and MRI. A T4b stage tumor can be relatively easily diagnosed when the adjacent organ is destroyed and the boundary is lost due to tumor invasion. Judgment of tumor invasion is frequently difficult when the boundary is relatively clear, despite confirmation of the absence of a fat layer between the tumor and surrounding organs. Direct invasion is unlikely if the interstitial fat layer is visualized, but invasion is possible if no fat layer is visualized. For such cases, multiplanar reconstruction (MPR) CT images in sagittal and coronal views, in addition to the axial view, are useful for diagnosis[14]. Preparation of specific MPR images is possible using multidetector-row CT (MDCT). Similarly, a tumor can be diagnosed as cT4b using MRI if the boundary between the tumor and surrounding organs is lost, the normal structures of the surrounding organs are destroyed, or no high-intensity fatty region is present between the tumor and adjacent organs. For evaluation of adjacent organ invasion, T2-weighted MRI gives superior contrast resolution in soft tissue and better spatial resolution (Fig. 2).

4) Evaluation of a requirement for resection with a secure CRM

Evaluation of the need for surgery with a secure CRM mainly depends on the relationship between the tumor and perirectal fascia. The CRM is very likely to be positive in a case in which the tumor passes through the perirectal fascia and advances near the pelvic wall. This is of importance because a positive CRM is a risk factor for local recurrence, and for distant recurrence and poor prognostic factors[15]. In cases in which invasion within 1 mm from the perirectal fascia is suspected on preoperative MRI, the CRM is often found to be positive histologically and the risk of local recurrence is high[16]. If the tumor reaches the perirectal fascia, it is likely that resection with a secure CRM cannot be applied in the layer transected by total mesorectal excision (TME) and this is an indication for possible adjuvant therapy. The perirectal fascia appears as a low-intensity region in intrapelvic fat tissue visualized as a high-intensity region on T1-weighted MRI[17] (Fig. 3, 4).

Endorectal ultrasound is also useful for evaluation of the perirectal fascia, and a high NPV

Fig. 2 Case of T4b vagina cancer with the boundary lost due to tumor invasion (MRI: T2WI)
(This figure was reprinted from reference 14, Fig. 2 with permission.)

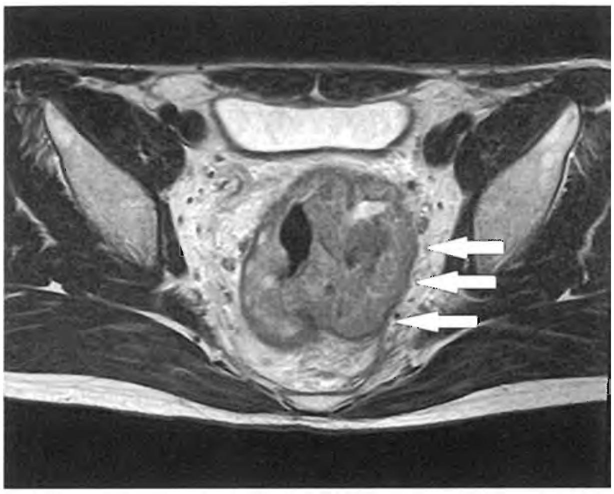


Fig. 4 Case in which the tumor reached the perirectal fascia (MRI: T2WI)
Neoadjuvant chemotheraphy was performed because resection with a secure CRM was difficult.

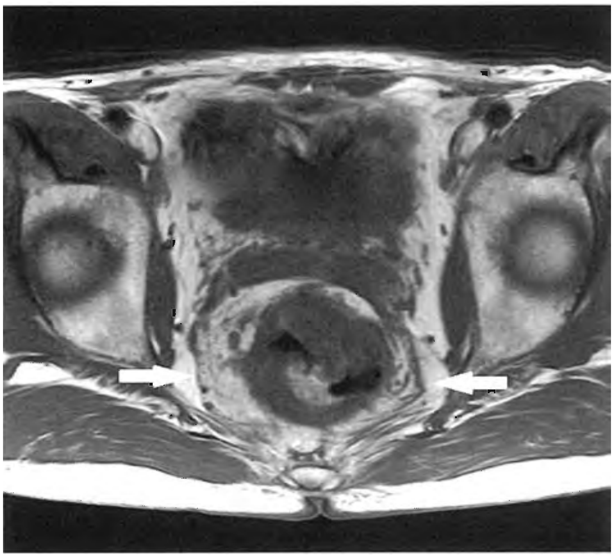


Fig. 3 Perirectal fascia (MRI: T1WI)
The perirectal fascia appears as a low-intensity region in intrapelvic fat tissue visualized as a high-intensity region on T1-weighted MRI. (This figure was reprinted from reference 14, Fig. 5 with permission.)

for evaluation of lower rectal cancer has been reported[18].

5) Diagnosis of lymph node metastasis as an indication for lateral lymph node dissection

The standard treatment for advanced lower rectal cancer in Western countries is TME + CRT without LLD[19], based on regarding of lateral lymph node metastasis as a metastatic disease. Meta-analyses of the therapeutic effect of LLD have shown no significant differences in overall survival (OS), disease-free survival (DFS), and local and distant recurrence rates between groups with and without LLD, showing that this extended surgery has little significance[20]. In contrast, the efficacy of LLD has been shown in Japan, and TME + autonomous nerve-preserving LLD is the standard surgical procedure for advanced lower rectal cancer[21]. The lateral lymph nodes are classified as regional lymph nodes to be dissected using standard D3 dissection[22]. Regarding the therapeutic effect of LLD, 50% control of local recurrence and about an 8% increase in the 5-year survival rate have been reported in a multicenter study[21]. Case registration in prospective studies of preventive LLD for stage II and III rectal cancer has been completed. The results of a primary analysis to be carried out in 2015 will clarify the significance of preventive LLD for recurrence-free survival and local recurrence rate and recurrence site[23].

Akiyoshi et al[24] found that the survival rate of patients with internal iliac lymph node metastasis was comparable to that of cases with a TNM classification of N2a; and that the survival rate of patients with lateral lymph node metastasis, which is more distant than internal iliac lymph node, was comparable to that in cases with a classification of N2b. These findings show the validity of regarding the

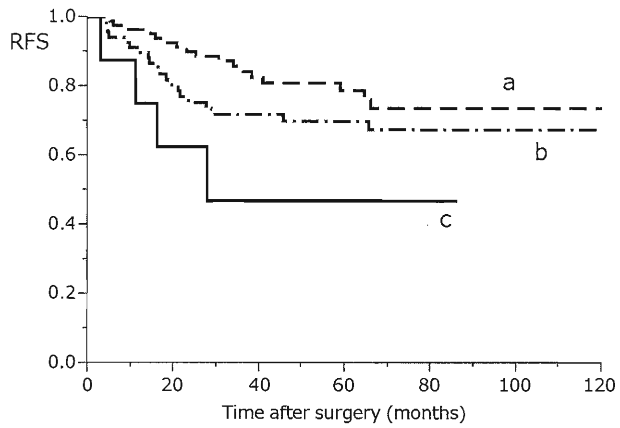


Fig. 5 Relapse-free survival (RFS) in patients with rectal cancer
a, lateral lymph node dissection (−); b, lateral lymph node dissection (+), metastasis (−); c, lateral lymph node dissection (+), metastasis (+).

lateral lymph nodes as regional lymph nodes. Also, >40% of cases with lateral lymph node metastasis with local recurrence do not have accompanying distant metastasis[25]. Thus, control of lateral lymph node metastasis is important in treatment of advanced lower rectal cancer. The rate of lateral lymph node metastasis in lower rectal cancer patients and the 5-year survival rate of patients with metastasis have been found to be 10.6−25.5%[26] and 37.3−49.3%[21], respectively. The 5-year relapse-free survival rate in cases with lateral lymph node metastasis in our department is 46.9% (Fig. 5). The results for these cases are poor compared to those for other cases (dissection(−): 78.7%; dissection(+), metastasis(−): 69.9%).

In Japanese Society for Cancer of the Colon and Rectum (JSCCR) guidelines for the treatment of colorectal cancer[27], LLD is indicated for cases in which the lower margin of the tumor is located on the anal side of the peritoneal reflection and the tumor has invaded through the MP. Thus, the indication is based on the occupied region and depth of invasion, which are metastasis risk factors, but not on clinical findings of lymph node metastasis, including intraoperative findings. In T2 or shallower cases, the lateral lymph node metastasis rates in cases treated with LLD are 5.4% in T1 cases and 9.2% in T2 cases. In T3 or deeper cases, this rate is 20.1%, indicating that lateral lymph node metastasis is not seen in about 80% of these cases[27].

The disadvantages of LLD include complications such as disturbance of urination and sexual dysfunction, increased operative time, and increased intraoperative blood loss[20]. Therefore, LLD should not be uniformly applied and it is important to select patients for whom LLD is likely to be beneficial based on the metastasis-positive rate, therapeutic effect, and potential complications. Thus, indication of LLD requires selection of optimal cases and this may be possible by combining diagnostic imaging findings with risk factors for lateral lymph node metastasis[14].

Metastasis may be diagnosed by superficial US[28], but is mainly diagnosed using CT and MRI. The lateral lymph nodes are located in a narrow space on the lateral pelvic wall surrounded by the external and internal iliac arteries, internal obturator muscle, and perirectal fascia on the anterior, posterior, lateral, and medial sides, respectively[29]. In this region, branches of the internal iliac artery for the organs and obturator artery are distributed in a complex way, and care is required with differentiation between lymph nodes and blood vessels. If the presence of lymph nodes cannot be verified in the axial view, approaches from various cross-sectional views are useful. In our laboratory, lymph nodes are located using a sagittal view in continuous MRI slices of the region between the bilateral external iliac arteries and veins (sagittal tomography at the pelvic lateral wall), with the aim of improving the diagnostic performance[29]. In the sagittal tomography at the pelvic lateral wall, the bifurcation of the internal and external iliac arteries and veins, morphology of the bifurcation of the internal iliac arterial branches for the organs, and distribution of the obturator artery can be visualized. Visualization of the vascular system in the same image makes it easier to differentiate between lymph nodes and blood vessels and to identify the region containing lymph nodes (Fig. 6). Diagnostic imaging results are shown in Table 1. Sensitivity and NPV were higher in CT than in MRI.

Various diagnostic criteria have been proposed for MRI, but diagnosis based on the lymph node

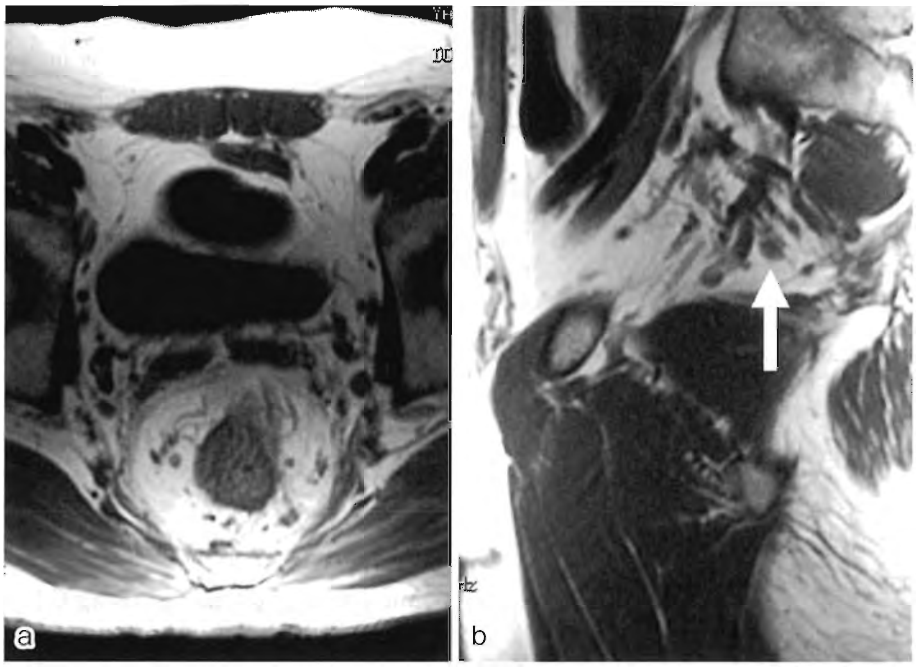


Fig. 6 Diagnosis of lateral lymph node metastasis using MRI (T1WI)
a, axial view; b, sagittal tomography of the pelvic lateral wall showing lateral lymph node swelling (⇨). Visualization of the vascular system in the same image permits differentiation between lymph nodes and blood vessels in the pelvic lateral wall.
(This figure was reprinted from reference 44, Fig. 1 with permission.)

Table 1 Diagnostic results for lymph node metastasis using CT and MRI

	Accuracy	Sensitivity	Specificity	PPV	NPV
Perirectal					
CT	64.3%	73.8%	54.8%	62.0%	67.6%
MRI	71.4%	88.1%	54.8%	66.1%	82.1%
Rt lateral					
CT	65.2%	50.0%	70.6%	37.5%	80.0%
MRI	69.6%	100%	58.8%	46.2%	100%
Lt lateral					
CT	70.4%	62.5%	73.7%	50.0%	82.4%
MRI	77.8%	87.5%	73.7%	58.3%	93.3%

size is generally accepted[30)~32)]. Recurrence in the lateral lymph nodes is the most frequent recurrence pattern in cases treated with TME + CRT without LLD, and a strong correlation with the preoperative lateral lymph node size has been reported[25)], showing the importance of size-based lymph node evaluation. Kim et al[25)] also suggested that size-based diagnosis of lymph node metastasis is currently the most reliable among diagnoses using MRI. Various criteria for the metastasis-positive size have been suggested. For example, the Lymph Node Committee of the JSCCR have prepared draft criteria as a greater minor axis of the pararectal lymph node ≥5 mm and a greater minor axis of the lateral lymph node ≥10 mm[33)].

The basis for size-based diagnosis is that metastasis-positive lymph nodes are larger than metastasis-negative lymph nodes. In a study comparing lymph node size in the "vulnerable field", in which metastasis is likely, the size of metastasis-positive lymph nodes (8.5 ± 4.1 mm) was significantly larger than that of metastasis-negative

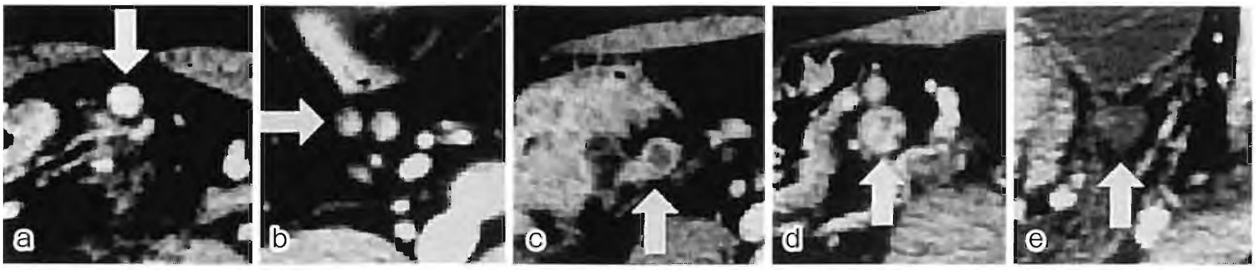


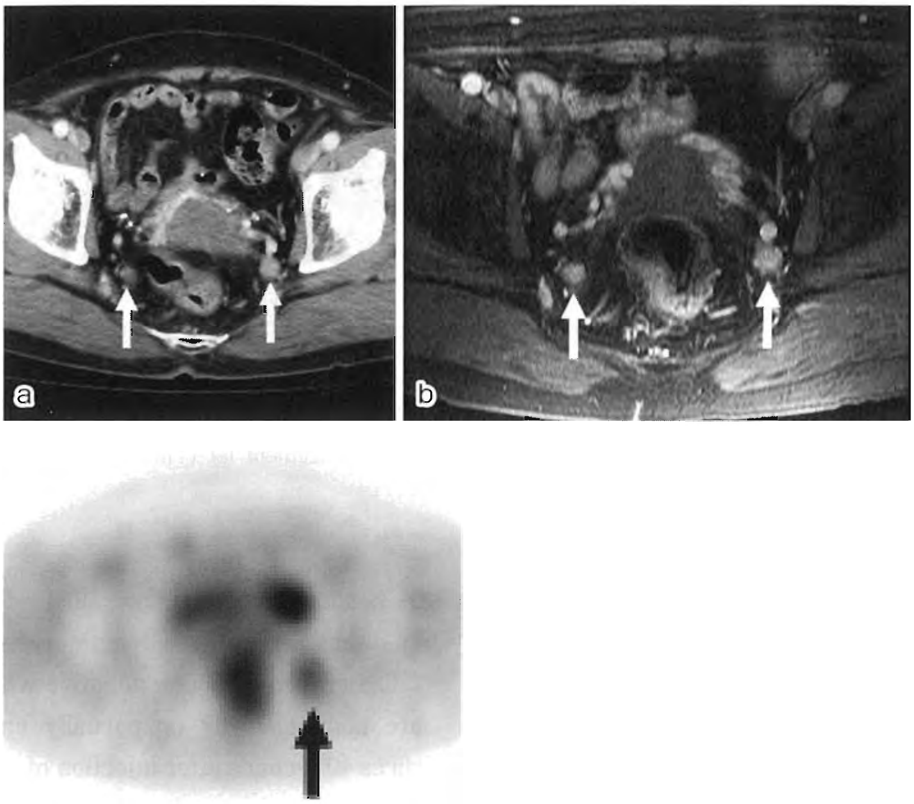
Fig. 7 Images of lymph nodes in thin slices 40 s after injection of contrast medium
a, homogenously enhanced; b, partially enhanced; c, marginal only; d, spotted; e, no enhancement. In contrast CT, metastasis may be negative when lymph nodes are homogenously (a) or partially (b) enhanced in thin slices 40 s after injection of contrast medium; and metastasis may be positive when only the marginal region is enhanced (c), there is a spotted pattern of enhancement (d), or there is no enhancement (e). (This figure was reprinted from reference 39, Fig. 6 with permission.)

lymph nodes (6.0 ± 2.8 mm)[34]. However, histograms of the maximum lymph node diameter of metastasis-positive and metastasis-negative lymph nodes also show wide overlap[35]. Thus, while selection is possible to an extent using lymph node size-based diagnosis, a strict cut-off cannot be established.

In contrast, diagnosis based on morphological criteria, such as signal heterogeneity and an irregular border, may be useful since such criteria are not based on the lesion size[35][36]. However, evaluation of the morphology and properties can be difficult for small lymph nodes of ≤4 mm[37]. Similarly, establishment of a benign or malignant status on high-resolution MRI is difficult for lymph nodes of ≤5 mm, although 2 mm lymph nodes can be visualized[38]. Therefore, at present, diagnosis based on morphological criteria is also limited.

A diagnostic method using qualitative factors may solve these problems. Our laboratory has investigated qualitative diagnosis of lymph node metastasis not based on size, but on changes in blood flow in lymph nodes corresponding to spatial occupation and variable necrosis of cancer cells. Using histological findings to classify tumors, we found that type I lesions have abundant blood flow (radial blood flow) in intraoperative US color Doppler imaging (CDI), as a feature of metastasis-negative lymph nodes; whereas type IIa lesions have poor blood flow (thin, irregular blood flow), type IIb lesions have blood flow biased to the margin, and type III lesions have no blood flow, all of which are features of metastasis-positive lymph nodes[39]. In contrast CT, metastasis may be negative when lymph nodes are homogenously or partially enhanced in thin slices 40 seconds after injection of contrast medium; and metastasis may be positive when only the marginal region is enhanced, a spotted pattern of enhancement is observed, or there is no enhancement[40] (Fig. 7).

^{18}F-fluorodeoxyglucose (FDG)-PET[41][42] and diffusion-weighted MRI[43] have recently been investigated as qualitative diagnostic methods for lymph node metastasis. Ultrasmall superparamagnetic iron oxide contrast agent (USPIO) is a lymph node-specific contrast medium, and USPIO-enhanced MRI has been investigated for diagnosis of lymph node metastasis, but these approaches are still not generally performed in Japan[44]. Diagnosis of lymph node metastasis using FDG-PET is highly specific and gives favorable positive predictive values. Similar diagnostic results have been obtained in our laboratory, but the sensitivity is low and many cases are false-negatives, indicating a clinical limitation[45] (Fig. 8). The sensitivity and specificity of perirectal lymph node detection by CT, MRI, and PET were 73.7% and 54.8%, 89.5% and 64.3%, and 28.9% and 97.6%, respectively[45]. However, these qualitative methods do not depend on the lesion size and morphology, and improvement of accuracy may produce reliable diagnostic approaches.



c

Fig. 8 Case of lateral lymph node metastasis
a, b, Swelling lymph node in a space on the bilateral pelvic wall (a, CT; b, dynamic MRI);
c, A left lateral lymph node, but no right lateral lymph node, was detected in FDG-PET.

6) Evaluation of liver metastasis

Concomitant synchronous distant metastasis and peritoneal metastasis markedly influence the therapeutic strategy. Evaluation of liver metastasis, which is the most common metastasis pattern, is particularly important. The prognosis of patients treated with resection of liver metastasis of colorectal cancer is relatively favorable and the Japanese guidelines for treatment of colorectal cancer recommend resection for resectable liver metastasis[27]. In addition, "conversion therapy" has recently been attempted with the goal of improving treatment outcomes of non-resectable and borderline resectable cases. In this approach, anticancer drugs are administered before surgery to reduce the tumor size and liver metastasis is resected when the lesion becomes resectable[46].

Liver metastasis is mainly evaluated using US, CT, MRI and FDG-PET[47]. Among these techniques, MRI has been found to be the most useful for visualization of liver metastasis of colorectal cancer in meta-analysis[48]. In comparison with FDG-PET, Seo et al[49] showed that gadoxetate disodium-enhanced MRI (EOB-MRI) is highly sensitive with a high NPV, and is particularly superior in visualizing micrometastatic lesions of size 1.0 cm or smaller.

Conclusion

In this review, we have discussed the objectives and practical points of preoperative diagnostic imaging performed to determine the therapeutic strategy for rectal cancer. Planning of optimal treatment without excess stress requires a full understanding of the findings and limitations of diagnostic imaging. Imaging accuracy largely depends on diagnostic devices and contrast medium, and further developments in these areas are likely to increase the diagnostic accuracy.

The authors indicated no conflicts of interest.

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治療方針決定のための直腸癌術前画像診断
—画像診断のポイントと現状—

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直腸癌の治療方針決定のために術前評価として行われる画像診断の目的や実際のポイントなどについて解説した．直腸癌の治療法は病期によって異なり，病期は，壁深達度，リンパ節転移度，遠隔転移や腹膜転移の有無などから決定される．これらの評価は，注腸，下部消化管内視鏡，ultrasonography (US)，computed tomography (CT)，magnetic resonance imaging (MRI)，^{18}F-fluorodeoxyglucose-positron emission tomography (FDG-PET) などの様々な画像診断で行われる．特に，治療方針決定のポイントとして，早期癌では，リンパ節転移の可能性がある T1b 癌の診断，進行癌では，括約筋温存術の適応，隣接臓器合併切除の必要性，circumferential resection margin (CRM) を確保した切除の可否，側方リンパ節郭清の適応などが挙げられる．過大な侵襲を伴わない，過不足のない至適な治療を行うためにも，実際の画像診断の精度やポイントをよく理解して，正確な評価を行うことが重要である．