**Effective dissection for rectal cancer with lateral lymph node metastasis based on prognostic factors and recurrence type**

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**Abstract**

**Purpose** There are no reports showing the significance and effective range of dissection for patients with lateral lymph node metastasis (LLNM). This study aimed to investigate the indications for lateral lymph node dissection (LLND) in patients with LLNM based on prognostic factors and recurrence types.

**Methods** We reviewed 379 patients with advanced rectal cancer who were treated with total mesorectal excision plus LLND. We analyzed background factors and survival times of patients who had LLNM to determine prognostic factors and recurrence types.

**Results** Pathological LLNM occurred in 44 (11.6%). Among patients with LLNM, the predictors of poor prognoses, according to univariate analysis, were > 3 node metastases, the presence of node metastasis on both sides, and spreading beyond the internal iliac lymph nodes. Moreover, LLNM beyond the internal iliac region was found to be an independent prognostic risk factor. Twenty-eight of the 44 patients with lateral lymph node metastasis (64%) relapsed, 22 of whom had distant metastases and 11 of whom experienced local recurrences. Among the latter group, nine (20%) and two (5%) had recurrences in the central and lateral pelvis, respectively.

**Conclusion** The therapeutic benefit of resection was high, especially in patients with ≤ 3 positive lateral lymph nodes, one-sided bilateral lymph node areas, and positive nodes localized near the internal iliac artery.

**Keywords** Lateral lymph node dissection · Lateral lymph node metastasis · Prognostic factor · Rectal cancer · Total mesorectal excision

**Introduction**

For advanced rectal cancer, when the tumor is located below the peritoneal reflection, the incidence of lateral lymph node metastasis (LLNM) is 14–30%, and the prognosis for patients with LLNM is poor [1, 2]. Therefore, it is important to improve the treatment outcomes in cases of LLNM in order to anticipate better treatment results with lower rectal cancer, in general. Total mesorectal excision (TME) is used to treat lower rectal cancer in hospitals worldwide [3, 4]. Since advanced rectal cancer is known to have more local recurrence when treated only with TME, national guidelines suggest that various preoperative treatment strategies precede TME in order to reduce local recurrence [5]. In Europe and the USA, preoperative chemoradiotherapy (CRT) and TME are the standard treatment methods, whereas the conventional treatment methods in Japan are TME and lateral lymph node dissection (LLND) [6]. Local recurrence of rectal cancer includes recurrence due to an inadequate circumferential resection margin (CRM) and recurrence due to lateral lymph node involvement. Although local recurrence caused by inadequate CRM cannot be compensated using LLND, the technique has an advantageous preventive effect on lateral lymph node recurrence. Conversely, there is little evidence of the therapeutic effect of CRT on LLNM. According to a Japanese study, incidences of lymph node metastasis in 2916 patients with rectal cancer accounted for 20.1%. Among those who underwent LLND, however, the risk of pelvic recurrence was reduced by 50% and the 5-year survival rate was expected to improve by 8–9% [1]. Therefore, in high-volume centers in Japan, the recommended standard procedure for advanced low rectal cancer is TME plus central D3 resection and bilateral LLND.
In the JCOG0212 large-scale clinical trial that mainly targeted patients with clinically negative LLNM [7], the local recurrence rate in patients who underwent LLND was significantly lower than that of patients who did not undergo the procedure. LLND was particularly effective in suppressing local recurrence within the lateral pelvis, including the lateral lymph nodes [8]. Nonetheless, the results did not indicate that LLND improved overall survival. However, the therapeutic effect of LLND on patients with LLNM has not been clarified, and there is no prospective large-scale clinical trial showing this crucial data.

Previously, it has been reported that the dissection effect is high in cases with a small number of lateral lymph node metastases and in cases in which the metastases exist only in a limited area, but dissection does contribute to improved survival [9, 10]. However, there is no report showing the significance and effective range of dissection for LLNM. For these reasons, our study aimed to investigate the indications for LLND based on prognostic factors and recurrence type in patients with LLNM.

**Materials and methods**

**Patients**

Between April 2001 and June 2017, 437 patients with low rectal cancer where tumor borders were below the peritoneal reflection underwent TME with LLND. The primary tumors were addressed pathologically with R0 resection at the Department of Gastroenterological Surgery, Hirosaki University. This study is from a single center, and the laboratory data or imaging data of all cases have been reviewed at a preoperative conference involving experienced surgeons. A total of 379 patients were included in our study after excluding 58 patients; none received CRT. The indication of neoadjuvant chemotherapy was determined in the same manner as pStage III. In principle, S-1 or UFT/LV therapy was to be started within 8 weeks after surgery. However, depending on the postoperative stage, the addition of oxaliplatin or even omission of postoperative adjuvant chemotherapy was at the discretion of the attending physician.

**Statistical analysis**

Survival analyses were performed using the Kaplan-Meier method with the log-rank test. Categorical variables are presented as patient percentages. *P*-values < 0.05 were considered statistically significant. All statistical analyses were performed using SPSS version 24 (IBM Inc., Armonk, NY).

**Results**

**Clinicopathological details**

The attributes of all 379 patients are shown in Table 1. The average age was 62 years (range: 24–80 years), and 70% were male. Lower rectal cancer (Rb) was diagnosed in 326 patients (86%), while the remaining subjects had upper rectal cancer (Ra). A pathologic wall depth of pT3 was found in 210 patients (55%). Pathological mesorectal lymph node metastasis was observed in 158 patients (42%) and pathological LLNM in 44 (11.6%). Neoadjuvant chemotherapy was administered to 58 patients; none received CRT. The indication of neoadjuvant chemotherapy was determined in the same manner as...
our new prospective study evaluating neoadjuvant chemotherapy without CRT for lower rectal cancer (unique trial no. jRCTs021180033). One hundred eighty-two patients (48.0%) were given adjuvant chemotherapy. Table 2 shows the rate of positive LLNM for pT1 (3.7%), pT2 (6.6%), pT3 (13.3%), and pT4 (15.2%).

Surgical outcomes

Patient surgical outcomes are summarized in Table 3. The mean operation time was 243 min, while the mean blood loss was 532 ml. Low anterior resection was the most common procedure (164 patients), and R0 excision was achieved for the primary lesion combined with proximal D3 node dissection in almost all patients. Thirty-eight patients underwent laparoscopic surgery, which tended to last longer than laparotomy, albeit with less bleeding. The median post-surgery hospitalization period was 26 days. In Japan, the length of hospital stay generally includes the period of medical treatment until food intake, defecation, and recovery of motor function after surgery, so the length of hospital stay tends to be longer than in Europe and the USA. Hospitalization can be significantly longer, especially when serious complications develop. Postoperative complications included anastomotic leakage in 57 (19%) of the 299 patients in whom low anterior resection plus intersphincteric resection was performed. Cases with large tumors and cases with NAC tended to have more anastomotic insufficiency and intra-abdominal abscesses.

Perineal wound infections occurred in 27 (38%) of the 80 patients who underwent the combination of abdominoperineal resection and total pelvic exenteration. The onset of abdominal wound infection was noted in 17 patients (4.4%), ileus in 20 (5.3%), and pelvic abscess in 26 (6.9%). In addition to the patients in whom total pelvic exenteration was performed, 11 patients with dysuria (2.6%) required a urinary catheter at the time of hospital discharge.

Prognosis

The median observation period was 60.4 months (range: 36–96 months). Figure 2 shows relapse-free survival and overall survival. Among patients who underwent LLND, the 5-year survival rate was 55% and 85% for those with and without metastases, respectively ($P < 0.01$). Table 4 shows univariate and multivariate analysis of all patients who had TME and LLND. Among patients who underwent LLND, the predictors of poorer prognoses were identified as stage III disease, poorly differentiated tissue type, pT3–4, mesenteric lymph node metastasis, LLNM, venous invasion, or lymphatic invasion. On multivariate analysis, pT3–4 and lymphatic invasion were
independent risk factors of poorer survival. Among patients with LLNM, the predictors of poor prognoses according to univariate analysis were > 3 node metastases, the presence of node metastasis on both sides, and spreading outside the internal iliac lymph node region. On multivariate analysis, LLNM outside the internal iliac and obturator lymph node area was found to be an independent prognostic risk factor (Table 5).

Recurrence

Figure 3 shows a flowchart of recurrence in patients with LLNM. Twenty-eight of the 44 patients with LLNM (64%) relapsed; 11 experienced local recurrences (nine in the central pelvis and two in the lateral pelvis) while 22 (79%) had distant recurrences. Figure 4 shows a flowchart of recurrence in patients without LLNM. Seventy-nine of the 335 patients with LLNM (23.6%) relapsed; 32 experienced local recurrences (30 in the central pelvis and two in the lateral pelvis) while 61 (77.2%) had distant recurrences.

### Table 1 Patient characteristics

| Characteristics                        | n = 379 |
|----------------------------------------|---------|
| Sex                                     |         |
| Male                                    | 264     |
| Female                                  | 115     |
| Age (year)                              |         |
| Median                                  | 62      |
| Range                                   | 24–80   |
| Tumor location*                         |         |
| Ra                                      | 53      |
| Rb                                      | 326     |
| Tumor size (mm)                         |         |
| < 50                                    | 175     |
| ≥ 50                                    | 204     |
| Clinical stage                          |         |
| II                                      | 181     |
| III                                     | 198     |
| Histological type                       |         |
| Well/moderate                           | 76      |
| Mucinous/poor/signet                    | 303     |
| Pathological T category                 |         |
| pT1                                     | 27      |
| pT2                                     | 76      |
| pT3                                     | 210     |
| pT4                                     | 66      |
| Pathological mesorectal LN metastasis   |         |
| Absent                                  | 221     |
| Present                                 | 158     |
| Pathological lateral LN metastasis      |         |
| Absent                                  | 335     |
| Present                                 | 44      |
| Vascular invasion                       |         |
| Absent                                  | 163     |
| Present                                 | 216     |
| Lymphatic invasion                      |         |
| Absent                                  | 78      |
| Present                                 | 301     |
| Neoadjuvant chemotherapy                |         |
| No                                      | 321     |
| Yes                                     | 58      |
| Adjuvant chemotherapy                   |         |
| No                                      | 197     |
| Yes                                     | 182     |

*Ra, tumor located above the peritoneal reflection; Rb, tumor located the peritoneal reflection

### Table 2 Rate of LLNM for pT1, pT2, pT3 and pT4

| Pathological T category (N = 379) | Lateral lymph node metastasis (N = 44) |
|-----------------------------------|----------------------------------------|
| pT1                               | 27                                     |
| pT2                               | 76                                     |
| pT3                               | 210                                    |
| pT4                               | 66                                     |

| Pathological T category (N = 379) | Lateral lymph node metastasis (N = 44) |
|-----------------------------------|----------------------------------------|
| pT1                               | 1 (3.7%)                               |
| pT2                               | 5 (6.6%)                               |
| pT3                               | 28 (13.3%)                             |
| pT4                               | 10 (15.0%)                             |

### Table 3 Operative outcomes

| Variables                             | Value |
|---------------------------------------|-------|
| Operative procedure                   |       |
| Low anterior resection                | 164   |
| Intersphincteric resection            | 135   |
| Hartmann’s procedure                  | 8     |
| Abdominoperitoneal resection          | 67    |
| Total pelvic exenteration             | 5     |
| Open or laparoscopic assisted         |       |
| Open surgery                          | 341   |
| Laparoscopic assisted                 | 38    |
| Operation time (min) (range)          | 243 (86–633) |
| Total blood loss (ml) (range)         | 532 (5–2500) |
| Postoperative hospital days (day) (rage) | 26 (8–144) |
| Operative complication (cases)        |       |
| Anastomotic leakage                   | 57 (19%) |
| Perineal wound infection              | 27 (33%) |
| Abdominal wound infection             | 17 (4.4%) |
| Paralytic ileus                       | 18 (4.7%) |
| Bowel obstruction                     | 20 (5.3%) |
| Urinary retention requiring           | 11 (2.6%) |
| self-catheterization at discharge     |       |
| Bleeding                              | 3 (0.8%) |
| Pelvic abscess                        | 26 (6.9%) |
Examination of prognostic factors revealed that metastases of 
> 3 nodes, the presence of node metastasis on both sides, and 
spreading outside the internal iliac lymph node region led to a 
poor prognosis. LLNM outside the internal iliac and obturator 
lymph node area, in particular, was found to be an independent 
prognostic risk factor. The indication of LLND for patients with LLNM differs depending upon whether the LLNM 
is considered to consist of local metastases that can be cured 
locally [14]. There are various opinions on whether and how 

| Variables                        | Univariate analysis | Multivariate analysis |
|----------------------------------|---------------------|-----------------------|
|                                  | HR      | 95% CI        | P value | HR      | 95% CI        | P value |
| Sex                              | 0.793   |               |         |         |               |         |
| Male                             | 1       |               |         |         |               |         |
| Female                           | 0.934   | 0.558–1.562   | 0.378   |         |               |         |
| Age (year)                       |         |               |         |         |               |         |
| ≤ 60                             | 1       |               |         |         |               |         |
| > 60                             | 0.807   | 0.501–1.299   |         |         |               |         |
| Tumor location*                  | 0.761   |               |         |         |               |         |
| Ra                               | 1       |               |         |         |               |         |
| Rb                               | 0.907   | 0.485–1.696   |         |         |               |         |
| Tumor size (mm)                  | 0.799   |               |         |         |               |         |
| < 50                             | 1       |               |         |         |               |         |
| ≥ 50                             | 1.065   | 0.658–1.722   |         |         |               |         |
| Clinical stage                   | 0.001   |               | 0.065   |         |               |         |
| III                              | 1       |               |         |         |               |         |
| Histological type                |         |               |         |         |               |         |
| Well/moderate                    |         |               |         |         |               |         |
| Mucinous/poor/signet             | 3.418   | 1.371–8.522   | 0.002   | 1.000   | 0.973         | 0.073   |
| Operative procedure              | 0.052   |               |         |         |               |         |
| Sphincter preservation/Hartmann  | 1       |               |         |         |               |         |
| APR/TPE                          | 1.727   | 0.996–2.993   |         |         |               |         |
| pT                               |         |               |         |         |               |         |
| pT0-2                            | 1       |               |         |         |               |         |
| pT3-4                            | 6.324   | 2.302–17.371  | 0.001   | 1.000   | 1.140         | 0.497   |
| Pathological mesorectal LN metastasis |         |               |         |         |               |         |
| Absent                           | 1       |               |         |         |               |         |
| Present                          | 5.177   | 2.954–9.074   | 0.001   | 1.000   | 5.177         | 0.001   |
| Pathological lateral LN metastasis |         |               |         |         |               |         |
| Absent                           | 1       |               |         |         |               |         |
| Present                          | 3.145   | 1.834–5.394   | 0.001   | 1.000   | 3.145         | 0.001   |
| Vascular invasion                |         |               |         |         |               |         |
| Absent                           | 1       |               |         |         |               |         |
| Present                          | 1.944   | 1.200–3.150   | 0.001   | 1.000   | 1.944         | 0.001   |
| Lymphatic invasion               |         |               |         |         |               |         |
| Absent                           | 1       |               |         |         |               |         |
| Present                          | 2.575   | 1.599–4.149   | 0.001   | 1.000   | 2.575         | 0.001   |
| Neoadjuvant chemotherapy         |         |               |         |         |               |         |
| No                               | 1       |               |         |         |               |         |
| Yes                              | 1.140   | 0.492–2.640   | 0.760   |         |               |         |

*Ra, tumor located above the peritoneal reflection; Rb, tumor located the peritoneal reflection*

**Discussion**

Examination of prognostic factors revealed that metastases of 
> 3 nodes, the presence of node metastasis on both sides, and 
spreading outside the internal iliac lymph node region led to a 
poor prognosis. LLNM outside the internal iliac and obturator 
lymph node area, in particular, was found to be an independent 
prognostic risk factor. The indication of LLND for patients with LLNM differs depending upon whether the LLNM 
is considered to consist of local metastases that can be cured 
locally [14]. There are various opinions on whether and how
## Table 5 Prognostic factors of lateral lymph node metastasis

| Variables                        | Univariate analysis | Multivariate analysis |
|----------------------------------|---------------------|-----------------------|
|                                  | HR                  | 95% CI                | P value | HR | 95% CI | P value |
| Sex                              | 0.289               |                       |         |    |        |        |
| Male                             | 1                   |                       |         |    |        |        |
| Female                           | 0.603               | 0.237–1.536           | 0.662   |    |        |        |
| Age (year)                       |                     |                       |         |    |        |        |
| ≤ 60                             | 1                   |                       |         |    |        |        |
| > 60                             | 1.223               | 0.495–3.021           | 0.571   |    |        |        |
| Tumor location*                  |                     |                       |         |    |        |        |
| Ra                               | 1                   |                       |         |    |        |        |
| Rb                               | 21.418              | 0.001–8565.6          | 0.808   |    |        |        |
| Tumor size (mm)                  |                     |                       |         |    |        |        |
| < 50                             | 1                   |                       |         |    |        |        |
| ≥ 50                             | 1.12                | 0.449–2.792           | 0.343   |    |        |        |
| Clinical stage                   |                     |                       |         |    |        |        |
| II                               | 1                   |                       |         |    |        |        |
| III                              | 2.655               | 0.354–19.935          | 0.830   |    |        |        |
| Histological type                | 0.830               |                       |         |    |        |        |
| Well/moderate                    | 1                   |                       |         |    |        |        |
| Mucinous/poor/signet             | 0.873               | 0.253–3.013           | 0.593   |    |        |        |
| Operative procedure              |                     |                       |         |    |        |        |
| Sphincter preservation/Hartmann  | 1                   |                       |         |    |        |        |
| APR/TPE                          | 1.283               | 0.513–3.213           | 0.902   |    |        |        |
| pT                               |                     |                       |         |    |        |        |
| pT0-2                            | 1                   |                       |         |    |        |        |
| pT3-4                            | 0.274               | 0.522–9.909           | 0.274   |    |        |        |
| Pathological mesorectal LN metastasis | 0.269 |                       |         |    |        |        |
| Absent                           | 1                   |                       |         |    |        |        |
| Present                          | 25.179              | 0.082–7722.9          | 0.008   |    | 0.272  |        |
| Pathological lateral LN metastasis |                   |                       |         |    |        |        |
| < 3                              | 1                   |                       |         |    |        |        |
| ≥ 3                              | 0.308               | 0.129–0.732           | 1.548   |    | 0.710–3.377 |        |
| Pathological lateral LN metastasis |                   |                       |         |    |        |        |
| Unilateral                       | 1                   |                       |         |    |        |        |
| Bilateral                        | 3.258               | 1.401–7.575           | 1.068   |    | 0.499–2.284 |        |
| Pathological lateral LN metastasis |                   |                       |         |    |        |        |
| Internal iliac vascular region lymph nodes area | 0.048 |                       |         |    | 0.016  |        |
| Other obturator lymph node area   | 2.355               | 1.019–5.442           | 2.7     |    | 1.199–6.079 |        |
| Vascular invasion                | 0.365               |                       |         |    |        |        |
| Absent                           | 1                   |                       |         |    |        |        |
| Present                          | 1.543               | 0.604–3.939           | 0.537   |    |        |        |
| Lymphatic invasion               |                     |                       |         |    |        |        |
| Absent                           | 1                   |                       |         |    |        |        |
| Present                          | 1.887               | 0.251–14.180          | 0.479   |    |        |        |
| Neoadjuvant chemotherapy         |                     |                       |         |    |        |        |
| No                               | 1                   |                       |         |    |        |        |
| Yes                              | 1.646               | 0.479–5.655           | 0.356   |    |        |        |

*Ra, tumor located above the peritoneal reflection; Rb, tumor located the peritoneal reflection
bilateral LLND should be performed for LLNM [15], as there are other options, such as using selective LLND only for swollen lymph nodes [16] and omitting LLND, substituting CRT [17]. The therapeutic benefits of LLND for patients with LLNM have not yet been definitively determined.

One of the essential goals of treating rectal cancer is to reduce the local recurrence rate, and procedures to this effect are being optimized in various countries worldwide. In Japan, TME with autonomic nerve-sparing LLND has been performed for a long time [18, 19]. This differs from the therapeutic strategies employed in Europe and the USA, where the standard treatment methods are preoperative CRT followed by TME. The reason for this is that the local rectal lymphatic system below the inverted peritoneum flows in three directions: upward, laterally, and downward [20]. In addition to dissecting the regional and central lymph nodes along the inferior mesenteric artery, in Japan, it is thought that R0 resection is possible by dissecting the region along the lateral lymph flow [9].

LLND in patients with rectal cancer has been reported to reduce local recurrence rates and increase 5-year survival rates [21, 22]. Conversely, a meta-analysis of 20 patients indicated no improvement in prognosis following lateral LLND, although an increase in urogenital system complications was

![Fig. 2](image1.png) Relapse-free survival (a) and overall survival (b) rate of patients with and without lateral lymph node metastasis

![Fig. 3](image2.png) Recurrence rate of local and distant metastasis with lateral lymph node metastasis

- **Lateral lymph node metastasis**
  
  **Recurrence**
  
  - **Local recurrence** (N = 6)
    - Central pelvis (N = 4)
    - Lateral pelvis (N = 2)
  
  - **Local and distant recurrence** (N = 5)
    - Lung (N = 4)
    - Lymph node (N = 1)
  
  - **Distant recurrence** (N = 17)
    - Lung (N = 9)
    - Liver (N = 1)
    - Lung + liver (N = 3)
    - Lymph node (N = 4)
observed [23, 24]. However, many Japanese surgeons use autonomic nerve-preserving LLND techniques, which is more likely to prevent such complications [15]. Among patients enrolled in the JCOG0212 trial [8], there was no significant increase in the rate of urinary dysfunction for those who underwent LLND compared with other procedures. The incidence of urinary dysfunction is associated with tumor location and blood loss [25]. More recently, robot-assisted lateral resection has been reported to reduce urogenital system complications caused by this procedure [26].

On the other hand, preoperative CRT is reportedly effective in controlling local recurrence but does not necessarily improve the prognosis [27]. There are also reports of adverse events such as high incidences of urogenital system disorders, as well as radiation-induced venous thrombosis, intestinal obstruction, fistula development, transcervical fractures, and anal function failures [28, 29]. Akiyoshi et al. reported that 66% of patients who were diagnosed with metastasis of the lateral lymph nodes via preoperative imaging examinations and who underwent LLND after CRT were found not to be cancer-free pathologically [16]. It appears that CRT is not always sufficient to treat enlarged metastatic lateral lymph nodes, as it cannot completely eliminate lateral lymph node metastases. Hence, LLND is the most useful approach to achieving local control in patients with enlarged metastatic lateral lymph nodes, whereas preoperative CRT is not recommended [30].

In this study, among patients who underwent LLND with metastases, the 5-year survival rate was 55% and the rate of LLNM recurrence was 64%; among those with recurrences, 25% were local (5% in the lateral pelvis and 20% in the central pelvis) and 79% were distant. Although local control within the lateral lymph node region was reasonably achieved following LLND, it is also necessary to aim for high-quality TME to reduce the risk of recurrence in the central pelvis. R1 resection is one of the risk factors of local recurrence. However, in this study, the subjects were patients who had R0 resections. Of the 197 patients who did not undergo adjuvant chemotherapy, 24 (12.2%) relapsed. Since there is a risk of recurrence in cases with pStage II or lower, as well, it is necessary to consider the indication of adjuvant chemotherapy.

In general, the 5-year survival rate for patients with stage IV rectal cancer is 10–20% unless the metastatic tumors are excised [31, 32]. Our study showed that patients with lateral lymph node metastases had a better prognosis with LLND than that of stage IV patients. Kanemitsu et al. reported that, according to the index of the estimated benefits derived from LLND, dissection of the internal iliac and obturator nodes yielded similar therapeutic benefits as those expected from the dissection of the superior rectal artery lymph nodes [15]. Furthermore, Tamura et al. reported no oncological benefit from performing LLND in patients with stage IV disease who had both lateral and distant lymph node metastases [33]. Oh et al. reported that 59.1% of their patients with lateral lymph node metastases who underwent LLND also had distant metastases and poor prognoses [34]. LLND may be beneficial for patients with LLNM, but its indication is restricted if cancer cells have potentially spread to other areas of the body.

It is very difficult to determine the presence of LLNM before surgery. A previous study identified the risk factors for LLNM as female sex, lower rectal cancer location, lymphatic invasion, venous invasion, wall progression, and paraintestinal lymph node metastasis ≥ 5 mm in width on magnetic resonance imaging [35]. Another group found that the diagnostic ability for LLNM is more promising at a short axis of 5 mm than it is at 10 mm [36]. However, there are reports of pathological lymph node metastases being found in
approximately half of the lymph nodes that were judged to be small (< 5 mm) on diagnostic imaging [37, 38]. It may be difficult to evaluate the presence or absence of LLNM based only on the size of preoperative imaging. Hence, it may be necessary to more closely evaluate the shape and integrity of the lymph nodes in addition to the size for a more thorough analysis of the presence of metastases. Our research group recently reported that a combination of size-based diagnoses and dual-energy CT may increase the accuracy of a preoperative diagnosis of LLNM [39].

When accurate preoperative determination of LLNM is difficult, but metastasis is suspected, LLND is an appropriate approach for lower rectal cancer. The therapeutic effect of resection is considered high, especially in patients with ≤ 3 positive lateral lymph nodes, nodes on one side of the bilateral lymph node area, or nodes localized near the internal iliac artery. Local control is achievable for patients with LLNM following LLND; however, distant recurrence is frequent in LLNM. Given the high proportion of distant recurrences, a strategy that considers potent systemic chemotherapy for distant metastases is necessary to improve the survival rate of patients with lateral lymph node metastases.

The limitation of our research is that it was a retrospective study, and the study sample of LLNM (n = 44), which we used for determining risk factors, was small. Moreover, owing to the long study period, the laparotomy/laparoscopy procedures, chemotherapy regimens, scopes of lymph node resection, and treatment durations have evolved over the course of the study and were therefore inconsistent across the entire cohort. In Japan, traditionally, the mesorectum is peeled away and excised, after which it is examined for lymph node metastasis. Then, the rectum is opened and formalin is used to determine the extent of cancer. Thus, in this study, it was difficult to make an accurate pathological evaluation of CRM or TME quality on resected specimens in the same manner as in Europe and North America.

Conclusion

Based on the prognostic factors and the recurrence types of patients with LLNM, it was thought that LLND could control the metastasis limited to the internal iliac vessel region with less than three metastases on one side. It was considered necessary to treat LLNM as a systemic disease in cases in which metastasis spread further.

Availability of data and material Not applicable.
Code availability Not applicable.

Author contributions All authors contributed to the study conception and design. All authors read and approved the final manuscript.

Declarations

Ethics approval The study protocol was approved by the Institutional Ethics Committee of Hirosaki University Hospital (No. 2018-120)

Consent to participate Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare no conflict of interest.

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