# FUNCTION PRESERVING OPERATION FOR RECTAL CANCER BASED ON PREOPERATIVE STAGING BY ENDORECTAL EUS AND MRI BY TWO OBLIQUE METHOD

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**Background**

The significance of intrapelvic lymphadenectomy has been confirmed in rectal cancer surgery in Japan (1). Patients with rectal cancer, who received intrapelvic lymphadenectomy, may obtain better long-term survival after operation, but may have the urinary and sexual dysfuction caused by the injury of pelvic nerves at operation (2-4).

Preoperative staging, which is synthesized from various kinds of imagings including endorectal ultrasonography (EUS), computed tomography (CT), and magnetic resonance imaging (MRI) (5, 6), is very important in order to perform both operative curativity and postoperative quality of life (QOL).

It has been generally accepted that the incidence of intrapelvic lymphnode metastases depends upon tumor location and tumor depth. Tumor location can be easily defined by digital examination, barium enema or colonoscopy. The preoperative accuracy of tumor depth has also been improved by the development of endorectal EUS. The present problem may be how EUS assessment for tumor depth is applied to the determination of operation method of rectal cancer.

On the other hand, the identification of intrapelvic lymphnodes including the anatomical correlation with the branches of internal iliac artery is yet poor, and so the intrapelvic lymphnode dissection may be insufficient at operation. The blind extended intrapelvic lymphadenectomy, which injures the feeding vessels of pelvic organ and muscles, would decrease postoperative QOL of patients including the urinary or sexual dysfunction.

The present problem about the surgical treatment for rectal cancer is described from curativity and QOL based on our results. It has been investigated whether preoperative endorectal EUS and MRI of the pelvic cavity is significant or not in order to decide the indication for intrapelvic lymphadenectomy and perform an operation with more sufficient curativity and QOL.

**Materials and Methods**

From 1987 to 1997, 154 patients with rectal cancer received curative operation in the Second Department of surgery, Wakayama Medical School in Japan. Rectal cancer was classified into upper cancer (n=74: above 8 cm from anus), middle cancer (n=38: 5-8 cm) and lower cancer (n=38: below 5 cm) according to the distance from anal verge to the lower margin of tumor on preoperative colonoscopy.

Preoperatively, endorectal EUS was performed for 115 patients without tumor stenosis using Olympus CF-UM20 (radial scanning probe, 7.5 MHz transducer) after cleasing the colonic lumen with 2,000 ml of peroral polyethylene glycol solution. EUS was performed as follows. Rectal lumen was filled with deaerated water. A thin rubber sheath, which was placed over the transducer, was filled with about 50 ml of water Tumor depth was assessed according to the Mucosal (M; T1), the Submucosal (SM; T1), the Muscularis proprial (MP; T2), the Adventitial (A; T3) or Serosal (S; T3) invasion, and the tumor penetration into surrounding organs (Ai; T4). EUS assessment was compared with postoperative pathological tumor depth, and the accuracy of the examination was determined.

The application of EUS assessment for rectal cancer surgery is as follows. Patients with upper rectal cancer did not receive intrapelvic lymphadenectomy irrespective of tumor depth, although the upper lymphatic route along inferior mesenteric artery was dissected completely. Patients, who had middle rectal cancer with A (S) invasion or lower rectal cancer with MP of A (S) invasion on EUS, received intrapelvic lymphadenectomy as well as upper route lymphadenectomy. The incidence of lymphnode metastasis was compared among three groups.

Postoperative intrapelvic local recurrence was examined according to tumor location or depth of primary rectal cancer, and the extent of lymphnode metastasis at operation. Postoperative survival was compared among upper, middle and lower rectal cancer.

Since 1996, MRI imaging of the pelvic cavity has been performed for 41 patients by two oblique method using Hitachi MRH 500AD. It was aimed to detect intrapelvic lymphnode swelling correlating anatomically with the branches of the internal iliac artery. MRI by two oblique method, which was scanned with Tl weighted images of 12 slices every 8 mm, was performed on coronal oblique dimension connecting pubic tubercle and crista obturatoria, and on saggital oblique dimension with a 10 degree slope scanning from the saggital line (Figure 1).

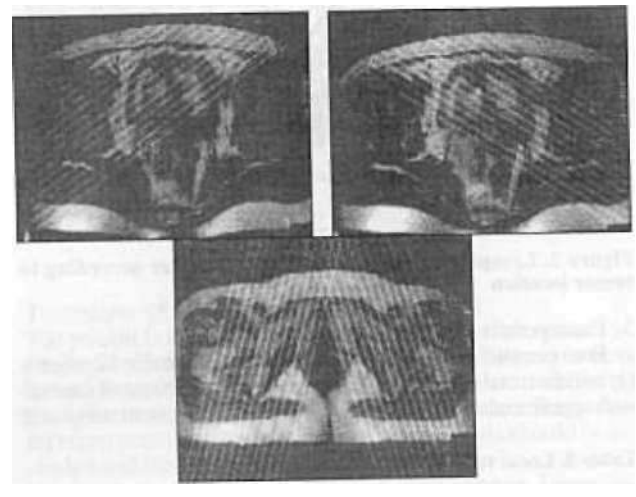


Figure 1. Preoperative MRI by two oblique method

After the introduction of preoperative MRI assessment, complete intrapelvic lymphadenectomy for the patients with middle or lower rectal cancer has been performed with pelvic autonomic nerve preserving. Preoperative MRI assessment for the intrapelvic lymphnode metastasis was compared with postoperative pathological findings.

Postoperative urinary disturbances, as an indicator of the postoperative QOL, were examined from 54 patients, composed of 21 with complete pelvic nerve preserving at operation and 33 with partial preserving or non-preserving. The degree of disturbances was divided into no disturbance, moderate disturbance (prolonged of urination, sense of residual urine), and self-catheterization.

## Results

1. Accuracy of tumor depth by preoperative endorectal EUS (Table 1)

The overall accuracy of endorectal EUS was 77.4% (T1: 80.0%, T2:64.3%, T3:82.3%, T4:25.0%), with 16.5%(19patients) overstaged and 7.1% (7 patients) understaged. Of 14 patients with T2 invasion on EUS, 14.3% was overstaged and 21.4% was understaged. Of 79 patients with T3 invasion on EUS, 16.5% was overstaged and only 1.3% was understaged.

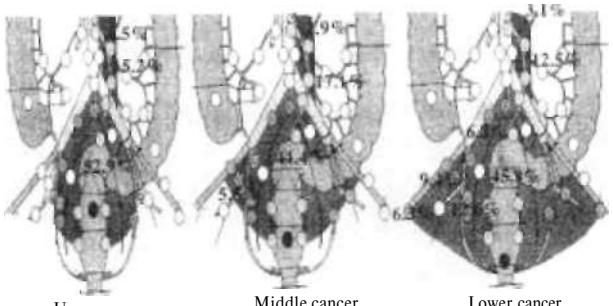
Table 1. Accuracy of endorectal EUS for the depth invasion of rectal cancer

| | | Pathological findings | | | | | Total | Accuracy |
|---|---|---|---|---|---|---|---|---|
| | | Early cancer | | Advanced cancer | | | | |
| | | m | sm | mp | a | ai | | |
| EUS | (M) | 6* | 1 | 1 | | | 8 | 75.0% |
| | T1 (SM) | 1 | 8* | 1 | | | 10 | 80.0% |
| | T2 (MP) | | 2 | 9* | 3 | | 14 | 64.3% |
| | T3 (A) | | 2 | 11 | 65* | 1 | 79 | 82.3% |
| | T4 (Ai) | | | 1 | 2 | 1* | 4 | 25.0% |
| | Total | 7 | 13 | 23 | 70 | 2 | 115 | 77.4% |

* accurate diagnosis

2. Lymphnode metastasis according to tumor location of rectal cancer (Figure 2)

The incidence of the lymphnode metastasis was 52.9% along the upper route in upper rectal cancer. It was 44.4% along the upper lymphatic route, and 5.8% along the intrapelvic route in middle rectal cancer. It was 45.9%, and 18.9% in lower rectal cancer, respectively.



Upper cancer (n=74) | Middle cancer (n=42) | Lower cancer (n=38)

**Figure 2. Lymphnode metastasis of rectal cancer according to tumor location**

3. Postoperative local recurrence (Table 2)

Postoperative intrapelvic local recurrence appeared in 12 patients (1; middle rectal cancer, 11; lower rectal cancer). None of patients with upper rectal cancer had local recurrence. In 11 patients withlower rectal cancer, pathological tumor depth, which was showed mp invasion in two patients (EUS accuracy: 50%) and adventitial invasion in ten patients (EUS accuracy: 100%). It occurred in only one (2.3%) of 43 patients who had no lymphnode metastasis in middle and lower rectal cancers at operation. It was showed retrospectively that 11 (91.7%) patients had had lymphnode metastases along the upper route, and 6 (50.0%) along the intrapelvic route at operation.

**Table 2. Local recurrence of rectal cancer**

| Location of cancer | Patient (age, sex) | Preoperation Tumor location | EUS | MRI | Operation | Postoperative findings Tumor depth | Node metastasis upper | Node metastasis intrapelvic | Dukes | Recurrence (mo) |
|---|---|---|---|---|---|---|---|---|---|---|
| Middle | 1) 76 M | 6 | A | | APR | a | (+) | (–) | C | 38 |
| | 2) 52 F | 6 cm | A** | | APR* | a** | (+) | (–) | C | 24 |
| | 3) 76 M | 5 | MP*** | | APR | mp*** | (+) | (+) | C | 6 |
| | 4) 60 F | 5 | A | | APR | mp | (–) | (–) | B | 28 |
| | 5) 76 F | 5 | A | | APR | a | (+) | (+) | C | 11 |
| | 6) 71 M | 5 | A | | APR | a | (+) | (–) | C | 30 |
| Lower | 7) 38 M | 4 | A | | APR | a | (+) | (+) | C | 24 |
| | 8) 62 M | 2 | A | | APR | a | (+) | (+) | C | 20 |
| | 9) 43 F | 3 | A | | APR | a | (+) | (–) | C | 65 |
| | 10) 41 F | 3 | A | | APR | a | (+) | (–) | C | 9 |
| | 11) 62 M | 5 | A | (–) | APR | a | (+) | (–) | C | 12 |
| | 12) 64 M | 5 | A | (–) | APR | a | (+) | (+) | C | 28 |

APR* abdomino-perineal resection ** Adventitial layer *** Muscularis proprial layer

4. Postoperative survival (Figure 3)

Postoperative cumulative 5-year survival was significantly lower ($p<0.05$) in patients with lower rectal cancer (57.7%) than those with upper rectal cancer (68.3%) and those with middle rectal cancer (73.3%).

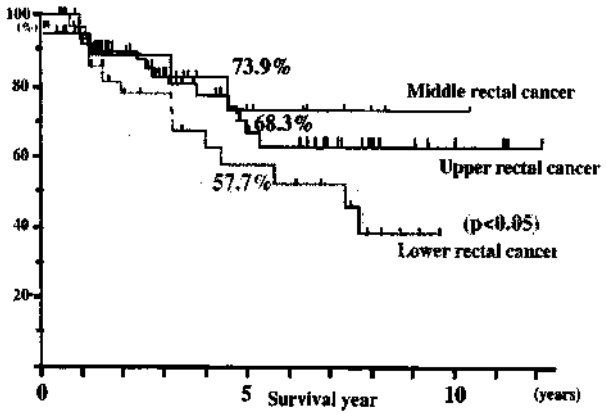



Figure 3. Postoperative survival of rectal cancer according to tumor location

5. Accuracy of intrapelvic lymphnode metastasis with MRI by two oblique method

Preoperative **MRI** imaging by two oblique method has been aimed for the complete dissection of intrapelvic lymphnodes. It could reveal the branches of internal iliac artery, including superior gluteal artery, superior vesical artery, obturator artery, inferior gluteal artery and internal pudendal artery. Particularly, sagittal oblique dimension showed the region around inferior gluteal artey, middle rectal artery, and internal pudendal artery near the pelvic plexus.

Postoperative pathological diagnosis was compared with preoperative MRI assessment. Overall accuracy was 90.2%. Positive sensitivity was 60.0% (3/5). The sensitivity was the highest for the lymphnode metastases along middle rectal artery, although it was poor for those in obturator space. Less than 5 mm sized metastaticlymphnodes was showed to have been false-negative on preoperative MRI.

6. Postoperative urinary disturbances

Of 21 patients with complete pelvic nerve preserving at operation, 18 (85.7%) had no urinary disturbances, and none needed self-catheterization. Of 33 patients who received extended intrapelvic lymphadenectomy with partial pelvic nerve preserving or non-preserving, 6 (18.2%) needed self-catheterization.

## Discussion

Local failure and urinary and sexual dysfunction after rectal cancer surgery remains unsolved (7), although some of new treatments have been introduced in recent years. In many Europien countries and the USA, preoperative radiation therapy and total mesorectal excision (TME) (8-10) at operation seems to be confirmed to achieve good local control.

On the other hand, in Japan, complete intrapelvic lymphadenectomy was performed in 1980's including the resection of pelvic autonomic nerves (1,4). It improved postoperative survival rate, but invited urinary and sexual dysfunction. At present, pelvic autonomic-nerve preserving operation (11,12) is the main current in the operation of advanced rectal cancer whether intrapelvic lymphadenectomy is performed or not.

Whether surgical treatment for rectal cancer can satisfy both curativity and postoperative QOL of patients or not depends wholly upon preoperative staging of cancer.

Tumor location is one of the important factors to determine the indication for intrapelvic lymphadenectomy. As tumor location lowered near the anal verge, the incidence of intrapelvic lymphnode metastasis increased. Patients with upper rectal cancer did not have local recurrence although they did not receive intrapelvic lymphadenectomy. Patients with middle rectal cancer had satisfactory survival after the conventional operation with intrapelvic lymphadenectomy, according to preoperative staging based on endorectal EUS assessment.

But, patients with lower rectal cancer existing within 5 cm from the anal verge had sometimes local recurrence postoperatively. Local recurrence occurred in patients who had received rectal amputation accompanied with total mesorectal excison. Considering that 10 (90.9%) of 11 patients were Dukes C including 6 (54.5%) patients with intrapelvic lymphnode metastasis, and that a period from operation to local recurrence was within 24 months in 7 (58.3%) of 12 patients, it is suggested that local control at operation was insufficient.

MRI imaging of the pelvic cavity by two oblique method has enabled us to reveal the anatomy of the branches of internal iliac artery, including superior gluteal artery, superior vesical artery, obturator artery, inferior gluteal artery and internal pudendal artery. Preoperative imaging of the branches of internal iliac artery and lymphnode swelling was very useful to perform more complete intrapelvic lymphadenectomy with the preserving of pelvic nerves and vessels. The lymphnode along middle rectal artery, which exists near the pelvic plexus, has the highest incidence of metastasis in patients with lower rectal cancer. The sagittal oblique assessment of MRI gave good sensitivity for that lymphnode. The size of the lymphnode is responsible for the detection with MRI (13). Less than 5 mm sized metastatic lymphnodes in obturator space could not be detected in this study. It is only three years since MRI imaging was introduced for preoperative staging of rectal cancer.

It was showed in our recent study mat pelvic autonomic nerve preserving operation decreased postoperative urinary disturbances. In the future, the decrease of postoperative local recurrence and the improvement of survival in lower rectal cancer is expected.

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