

Is endorectal ultrasound still useful for staging rectal cancer?

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Abstract. – OBJECTIVE: Staging in rectal carcinoma is important for planning treatment. Preoperative staging and treatment strategies have changed along with improvements in imaging techniques. The aim of this work is to evaluate the accuracy of endorectal ultrasound (ERUS) in rectal cancers, especially in low rectal cancers and stenotic cases.

PATIENTS AND METHODS: From January 2011 to December 2011, patients diagnosed with rectal cancer who were admitted to our endosonography unit for staging and who were operated on in our hospital were evaluated retrospectively. Patients who received neoadjuvant chemotherapy were excluded. Endosonographic staging was compared to postoperative pathological staging.

RESULTS: In total, 38 patients (28 males, 10 females) were included. Their mean age was 57.6 ± 11.3 years (27-75 years). Thirteen (34.2%) had stenotic lesions. The accuracy of ERUS for staging of lesions was evaluated according to pathology and was 73.7% overall (kappa coefficient = 0.317; $p = 0.002$). When patients were split into stenotic and non stenotic groups, the accuracy was 68% (kappa coefficient = 0.170; $p = 0.125$) for stenotic lesions and 84.6% (kappa coefficient = 0.606; $p = 0.001$) for non-stenotic lesions. Internal and external sphincter involvement were significantly correlated with the postoperative pathological evaluation in both groups.

CONCLUSIONS: Technological improvements in imaging methods have made the diagnosis and management of malignancies more precise. Low rectal tumours, have difficult characteristics for evaluation because of their unique location. Although ERUS has some disadvantages, it is still useful for T staging, evaluating sphincter involvement, and defining tumour size and distance from the anal verge. ERUS was less accurate for T staging of stenotic tumours, but the accuracy may still be within acceptable limits.

Key Words:

Endorectal ultrasound, Rectal cancer staging.

Introduction

Accurate staging in rectal carcinoma is important for planning treatment. Preoperative staging and treatment strategies have changed along with improvements in imaging techniques, such as endorectal ultrasonography (ERUS), magnetic resonance imaging (MRI), and computed tomography (CT)^{1,2}. Depth of tumour invasion and metastasis to lymph nodes and other organs change survival and treatment strategies. The tumour-node-metastasis (TNM) staging scheme remains the most important guide for treatment decisions and prognosis³. According to tumour stage, treatment options can range from endoscopic resection to surgical resection, such as low abdominal resection, abdominoperineal resection, and chemotherapy and/or radiotherapy³.

Background

Low rectal cancers, especially those in close proximity to the anal canal and internal and external anal sphincters are very difficult to handle for surgeons, gastroenterologists, radiologists, oncologists, histopathologists, and patients alike⁴. There may be a need for a permanent stoma because of the involvement of sphincters. The surgeon needs enough space to allow clear surgical margins and maintain sphincter function, yet treatment may also be affected by mesorectal fascia involvement and lesion location with peritoneal reflection⁴. Thus, the evaluation of low rectal cancers requires special consideration.

ERUS has been used in prostate and rectal diseases since 1983, and in 1985, Hildebrandt and Feifel used ERUS for the staging of rectal cancers; they defined ultrasonographic TNM staging⁵. Technological improvements in imaging techniques have proceeded very quickly since then, but every technique still has its own shortcomings and advantages.

ERUS is an easy and accurate technique for staging but its efficacy depends on the user's experience, although evaluation can be difficult with very large or mobile lesions⁶. In addition, there has been controversy over the accuracy of ERUS, especially for assessing stenotic lesions.

In this study, we evaluated the accuracy of ERUS, especially in patients with low rectal cancers, and the effects of the presence of tumoural stenosis on its accuracy. We used a histopathological evaluation as the gold standard.

Patients and Methods

All patients provided written informed consent for the procedures. Ethical approval for this study was obtained from the Gastroenterology Clinical Council.

From January 2011 to December 2011, patients who were diagnosed with rectal cancer, admitted to our endosonography unit for staging, and operated on in our hospital were evaluated retrospectively. All patients were diagnosed with histologically proven adenocarcinomas. Patients who received neoadjuvant chemo and/or radiotherapy before endosonography were excluded. Patients who decided to receive neoadjuvant chemoradiotherapy before the operation were also excluded to not affect the pathological staging evaluation.

We performed ERUS in our endosonography unit before a biopsy or at least 3 weeks after a biopsy to minimise any artefacts. Lesions within the first 10 cm from the dentate line endoscopically were included in the study. More proximal lesions were excluded. Those within the first 5 cm from the anal verge were defined as low rectal tumours. Colonoscopy or sigmoidoscopy was performed before the ERUS.

ERUS examinations were performed by SK or YO, endoscopists with at least 50 examinations of experience, and surgeries were performed by GN.

The B-K Medical Pro Focus scanner with a 10-16 MHz transducer was used for ERUS examinations. During ERUS, we routinely define the lesion using the following criteria: distance from the anal canal, endosonographic depth and length of lesion, infiltration of the perirectal area and/or neighbouring organs, internal ultrasonographic echo characteristics of the lesion, which part of the rectal wall is involved, presence of lymphadenopathy, and any relationship with the internal and external anal sphincters.

ERUS was performed with the patient in a left lateral position. Patients underwent one or two enemas within 2 h of the examination. It is an easy procedure for patients and no sedation was given.

We used the ultrasonographic TNM system of Hildebrandt⁵. According to this classification, a uT1 tumour was localised in the mucosa and submucosa, a uT2 tumour had invaded the muscularis propria, a uT3 tumour had reached the perirectal wall but not the surrounding organs, and a uT4 tumour had reached the surrounding organs. Round, hypoechoic lymph nodes and their sizes were also recorded. Lymph nodes larger than 5 mm were deemed malignant.

Patients with stenotic disease were noted and all patients were divided according to presence of tumoural stenosis, which makes impossible to reach proximal side of the lesion with rigid ERUS or not.

Statistical Analysis

Statistical analyses were performed using the IBM SPSS software (ver. 21.0, SPSS Inc., Chicago, IL, USA). Continuous variables are given as means $\pm$ standard deviations (SDs) and medians (minimum-maximum); non-continuous variables are given as numbers and percentages. The concordance between ultrasonographic results and the pathology are described in terms of sensitivity and specificity; accuracy is described according to the kappa coefficient. The significance level was set at $p < 0.05$.

Results

In total, 38 patients (28 males, 10 females: M/F = 73.7%/26.3%) were included. Their mean age was 57.6 ± 11.3 (range, 27-75) years. It was not possible to reach the proximal side of the lesion due to the stenotic nature of the disease in 13 of 38 (34.2%) patients; this group was defined as Group 1, and the other group, where we reached the proximal side of the lesion, was defined as Group 2. Demographic characteristics of the patients are given in Table I. Rectal bleeding was the major symptom for hospital admission (14/38, 36.8%).

The ERUS findings and pathological specimen findings are given in Tables II and III, respectively. According to ERUS, most patients (81.6%) were in stage 3. When pathological specimens

Table I. Demographic characteristics of patients.

		Mean $\pm$ SD	Min-Max
Age	Male	56.3 $\pm$ 11.9	27-75
	Female	61.3 $\pm$ 8.5	46-71
	Total	57.6 $\pm$ 11.3	27-75
		Number	%
Gender	Male	28	73.7
	Female	10	26.3
Lesion characteristics	Stenotic	13	34.2
	Non-stenotic	25	65.8

Table II. Endorectal ultrasonographic findings.

		Number	Percentage (%)
Stage	1	1	2.6
	2	2	5.3
	3	31	81.6
	4	4	10.5
Lymphadenopathy	Positive	27	71.1
	Negative	11	28.9
Internal sphincter involvement	Intact	31	81.6
	Affected	7	18.4
External sphincter involvement	Intact	31	81.6
	Affected	7	18.4
		Mean $\pm$ SD	Median [Min-Max]
Distance to anal canal		39.9 $\pm$ 28.4	40 [0-100]
Width of lesion		32.8 $\pm$ 14.5	30 [2-70]

Table III. Pathological specimen findings.

		Number	Percentage (%)
Stage	1	2	5.3
	2	7	18.4
	3	28	73.7
	4	1	2.6
Lymphadenopathy	Negative	21	55.3
	Positive	17	44.7
Internal sphincter involvement	Intact	26	83.9
	Affected	5	16.1
External sphincter involvement	Intact	27	87.1
	Affected	4	12.9
		Mean $\pm$ SD	Median [Min-Max]
Distance from anal canal		27.5 $\pm$ 17.4	27.5 [0-60]
Width		36.4 $\pm$ 15.9	35 [8-70]

were evaluated, it was also seen that most patients were in stage 3 (73.7%). Based on these results the accuracy of ERUS for staging of lesions was 73.7% (kappa coefficient = 0.317; p =

0.002). By group, the accuracy of ERUS was 68% (kappa coefficient = 0.170; p = 0.125) in group 1 and 84.6% (kappa coefficient = 0.606; p = 0.001) in group 2.

Table IV. Performance of ERUS compared to pathology.

	Sensitivity	Specificity	Accuracy	Kappa coefficient	<i>p</i>
Lymphadenopathy	41.2%	81.0%	63.2%	0.229	0.135
Internal sphincter involvement	100%	100%	100%	1.000	< 0.001
External sphincter involvement	100%	96.3%	96.8%	0.870	< 0.001

Assessments of lymphadenopathy, internal and external sphincter involvement, and the location, width, and distance of lesions from the anal canal are shown in Tables IV and V. By group, the sensitivity, specificity, and accuracy were 33.3%, 100%, and 69.2% (kappa coefficient = 0.35; $p = 0.097$) in group 1 and 45.5%, 71.4%, and 60% (kappa coefficient = 0.172 and $p = 0.383$) in group 2. ERUS and pathology results indicating internal and external sphincter involvement were significantly correlated in both groups.

In terms of the distance of the lesion from the anal canal and the determination of lesion width, ERUS and pathology-based results were well correlated, with correlation coefficients of 0.782 ($p < 0.001$) and 0.501 ($p = 0.002$), respectively. Broken down by group, the results were still well correlated, with correlation coefficients of 0.782 ($p = 0.005$) and 0.469 ($p = 0.171$) in group 1 and 0.797 ($p < 0.001$) and 0.566 ($p = 0.003$) in group 2. The sizes of the lesions in group 1 and group 2 were 35.3 ± 14.4 mm and 36.8 ± 16.7 mm, respectively, according to pathological specimens and 36.5 ± 15.7 mm and 32.6 ± 14.4 mm, respectively, according to ERUS.

Discussion

To estimate survival and plan treatment precisely in rectal cancer depends especially on the degree of invasion, lymph node involvement, and metastasis of the lesion. The lower rectum has unique characteristics and thus radiological evaluations, surgical dissections, and histopathological evaluations require somewhat different approaches.

Table V. Performance of ERUS compared to pathology.

	Correlation coefficient	<i>p</i>
Distance from anal canal	0.782	< 0.001
Width of lesion	0.501	0.002

ERUS remains an important diagnostic technique in rectal cancer. The technology behind ERUS, image quality, and endoscopic experience have all increased since the first use of echo endoscopes for this purpose. Although this method has some shortcomings, it is still one of the most accurate diagnostic tools for rectal cancer staging⁷. Staging in stenotic lesions is an important problem for rectal tumours. Stenotic lesion problems can be solved using mini probes, but this is still not very common and even ERUS is not universal, especially in developing countries.

Even with technological improvements in CT and MRI; ERUS is still the most accurate technique for describing local invasion in rectal tumours^{3,8}. The European Registration of Cancer Care (EURECCA) has stated that ERUS is the most accurate method for evaluating tumour penetration into the rectal wall⁹. However, ERUS is quite operator-dependent and experience affects the results; the accuracy of ERUS can range from 65% to 97%⁸. In a large multicentre study, the diagnostic accuracy of ERUS was lower than most values reported in the literature, being 50.8% for T1 lesions, 58.3% for T2 lesions, 73.5% for T3 lesions, and 44.4% for T4 lesions¹⁰. According to a meta-analysis, the sensitivities for T1, T2, T3, and T4 cancers were 87.8%, 80.2%, 96.4%, and 90.4, and the specificities were 98.3%, 95.6%, 90.6%, and 98.3%, respectively³. In the present study, the overall accuracy rate was 73.7%; the patient number was low for each group, so no subgroup analysis could be performed for each ultrasonographic T stage. Also, some patients underwent surgery before adjuvant chemoradiotherapy. Most of the patients underwent adjuvant chemoradiotherapy and surgery was performed after the procedure if the patients were suitable. Because we thought that chemoradiotherapy could change ERUS images, we only evaluated the results of patients who underwent surgery after ERUS. Although the accuracy of ERUS was lower for stenotic lesions, it was still within acceptable limits (68%).

We also found that ERUS was less accurate for assessing lymph node involvement than for T staging. In a previous meta-analysis¹¹, the sensitivity of ERUS was 73.2% and the specificity was 75.8% for the diagnosis of nodal involvement. Marone et al¹² reported the accuracy of ERUS to be 58% for advanced rectal cancers. In the present study, the overall accuracy rate was 63%. The accuracy of using ERUS to determine pathological lymphadenopathy did not show significant differences between the stenotic (group 1) and non-stenotic (group 2) groups (69.2% vs. 60%). However, the method was quite accurate for determining sphincter involvement and the length and width of the lesion. In the case of low rectal tumours, even in cases with stenosis, it is possible to use ERUS to assess sphincter involvement. Li et al¹³ documented 6 years of results using ERUS and concluded that its diagnostic accuracy for stenotic and ulcerated lesions was lower than for non-stenotic ones. In that study, the accuracy for non-stenotic and non-ulcerated lesions was 90.2%; our accuracy rate was 84.2%. Li et al¹³ also grouped lesions as ulcerated and non-ulcerated and found that ulcerated lesions were overstaged and stenotic lesions were understaged. We did not use ulceration as a criterion but the accuracy was lower for stenotic lesions, consistent with that previous study. However, even in these stenotic cases, ERUS defined sphincter involvement precisely, according to our results. In low rectal tumours, even the stenotic ones, ERUS provided a good evaluation of sphincter involvement and a moderate evaluation for T staging.

ERUS is also useful for determining the depth and width of the lesion for stenotic lesions within acceptable limits. Advances in MRI techniques have enabled the use of MRI for precisely evaluating rectal tumours, especially for mesorectal involvement^{13,14}. However, MRI is an expensive technique and advanced technology is necessary especially for the evaluation of low rectal tumours involving the sphincters. ERUS in experienced hands is quite useful and a guiding technique for rectal cancers, even in stenotic cases.

Conclusions

Technological improvements in imaging methods have made the diagnosis and management of malignancies more precise. Rectal tumours, especially low rectal tumours, have difficult charac-

teristics for evaluation because of their unique location. Although ERUS has some disadvantages, it remains useful for T staging, for evaluating sphincter involvement, and for defining tumour size and distance from the anal verge. While the method is less accurate for staging of stenotic tumours, the accuracy is still within acceptable limits, and the method still shows sphincter involvement very clearly. It is also easy to perform and an inexpensive method, compared to MRI. It is better to use a combination of techniques to evaluate tumours, but in experienced hands, ERUS remains the best method for evaluating the local staging of rectal tumours.

Conflict of Interest

The Authors declare that there are no conflicts of interest.

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