

## Comparing Results of Preoperative Staging of Rectal Tumor Using Endorectal Ultrasonography and Histopathology

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**Background:** Preoperative clinical staging of rectal tumors is very important to allow surgeons make informed decisions about the types of surgeries that should be performed. Endorectal ultrasonography (ERUS) is one of the tools that has been commonly used in clinical staging of rectal tumors. The aim of this study was to evaluate the accuracy of the preoperative rectal tumor staging using endorectal ultrasonography in comparison with the postoperative histopathological staging.

**Methods:** The histopathology findings of the 67 patients with rectal tumors who underwent preoperative ERUS were reviewed and compared.

**Results:** The overall accuracy of the ERUS assessment in the depth of tumor invasion was 88%, with overstaging at 9% and understaging at 3%. In determining perirectal nodal involvement of the 59 patients that were treated by radical rectal resection, the accuracy was 73%, with sensitivity of 77% and specificity of 70%.

**Conclusion:** ERUS is an objective, convenient, and highly accurate tool for preoperative rectal tumor staging, thus helping surgeons to determine the appropriate treatment modalities.

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**Key words:** preoperative staging, rectal tumor, endorectal ultrasonography.

The treatment modality for rectal tumors has changed during the last 20 years. The trend is toward local excision versus radical rectal resection with lymph node clearance for patients with early staged rectal cancer. There is also a preference for the sphincter saving procedure versus abdomino-perineal resection with permanent stoma in low-lying rectal tumors. In addition, preoperative chemoradiotherapy for local advanced staged cancer (T3 or T4 with or without lymph nodes involvement) is used to reduce local recurrence or increase resection rate. Hence, the preoperative clinical staging is very

important to determine the treatment strategy for patients with rectal tumors. In addition, the depth of tumor invasion and nodal involvement are especially important. Endorectal ultrasonography (ERUS) is one tool that is commonly used for clinical preoperative tumor staging because it assesses the depth of the tumor invasion and perirectal lymph nodes. The continued evolution of this instrument will make ERUS more accurate in staging and allow physicians to become more familiar with it. There were various reports on the accuracy of the depth of tumor invasion and nodal involvement in ERUS assessments.

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The accuracy may vary depending on the examiner and most reports in the literature consisted of more than one examiner in each study report. The aim of this study was to compare the accuracy of the preoperative rectal tumor staging with histopathology using the results of ERUS conducted by a single examiner.

## METHODS

From August 1996 through May 2000, a single examiner performed preoperative ERUS in 67 patients with rectal tumors. Patients with tumor recurrence, preoperative irradiation, incomplete study such as stenotic tumor or inaccessible tumor were excluded from this study. Each patient was placed in the left lateral position, digital anal examination was performed and assessments of the anorectum contour, tumor mobility and location were made when the tumor could be palpated. An ERUS probe (7.0 MHz or 10 MHz, type 3535, B&K medical, Denmark) with a rubber balloon attachment was carefully introduced into the rectum, passed by the tumor and continued to the rectal lumen above the tumor. The appropriate amount of gasless water was filled into the balloon to provide optimal acoustic interface with the rectal wall. The probe was withdrawn slowly to assess the depth of tumor invasion as proposed by Hildebrant and Feifel<sup>(1)</sup> and to detect the metastatic lymph nodes above, at or below the

tumor as proposed by Beynon et al.<sup>(2)</sup> The results were documented using a standard form. All patients were treated according to the referring proctologists' decisions. The surgical specimens were sent for histopathologic staging according to the pTNM classification. All patients with ultrasound tumor invasion staging (uT) were compared with the pathologic stage (pT) for the accuracy, overstaging and understaging. The ultrasound nodal stage (uN) was compared with the pathologic stage (pN) of the radical surgery patients for the accuracy, sensitivity, specificity, positive predictive value and negative predictive value.

## RESULTS

In the 67 patients that underwent preoperative ERUS, eight patients with preoperative clinical staging as early rectal cancer received transanal local excision. Radical surgical resection was performed in the remaining 59 patients. Overall accuracy, overstaging and understaging of ultrasound staging in patients with tumor invasion (uT) was 88%, 9% and 3%, respectively (Table 1). The accuracy of ultrasound nodal staging (uN) among the 59 patients who underwent radical surgical resection was 73% (Table 2) with sensitivity, specificity, positive predictive value and negative predictive value were 77%, 70%, 67% and 79%, respectively.

**Table 1.** ERUS Staging (uT) of Rectal Tumors Compared with Histopathologic Staging (pT)

	pT0 (N)	pT1 (N)	pT2 (N)	pT3 (N)	pT4 (N)	Total (N)	Overstage (%)	Understage (%)	Accuracy (%)
uT0	3	0	0	0	0	3	0	0	100
uT1	2	3	0	0	0	5	40	0	60
uT2	0	0	22	2	0	24	0	8	92
uT3	0	0	3	27	0	30	10	0	90
uT4	0	0	1	0	4	5	0	20	80
Total	5	3	26	29	4	67	9	3	88

**Table 2.** ERUS Nodal Detection Compared with Histopathologic Finding

	pN0	pN1	Total (N)	Accuracy (%)
uNo	20	10	30	67
uN1	6	23	29	79
Total	26	33	59	73

Sensitivity, 77%; specificity, 70%

Positive predictive value, 67%; negative predictive value, 79%

## DISCUSSION

At the present time, rectal tumor treatment methods mainly depend on the depth of the tumor invasion, and presence or absence of lymph node invasion. ERUS has been used by surgeons preoperatively to assess the tumor penetration and lymph node involvement. Comparisons with computed

tomography (CT), magnetic resonance imaging (MRI), and MRI with endorectal coil (MRIEC) showed that ERUS has superior accuracy in assessing tumor invasion.<sup>(3)</sup> In determining lymph node involvement, ERUS had higher accuracy and sensitivity than CT and MRI, but ERUS had lower accuracy, sensitivity and specificity than MRIEC.<sup>(3)</sup>

In our study, the accuracy of tumor invasion was 88% with overstaging at 9% and understaging at 3%. Although the accuracy of ERUS staging was different depending on the individual examiner,<sup>(4,5)</sup> our data was still compatible with other reports that revealed the accuracy was from 81% to 94%, with overstaging at 0% to 12% and understaging at 1% to 9%. The least accurate in determining the tumor invasion of our data was tumor invasion to the submucosa (uT1, 60%). All of the methods were overstaged. It may have occurred due to the difficulty in determining the muscularis mucosa to submucosa layer especially in patients with polypoid tumors that are always tightly compressed to the rectal wall. Garcia-Aguilar et al.<sup>(5)</sup> reported a 47% accuracy in uT1 of 105 patients with an almost equal of overstaging and understaging rate. Heintz et al.<sup>(6)</sup> reported a low accuracy of ERUS in the diagnosis uT1 tumors to argue against its use in selecting rectal tumors for local excision.

The accuracy in assessing T2 and T3 tumors of our data was up to 90%. It seems higher than the accuracy in some reports that revealed less than 70% which could be due to the skill and experience of examiner and our limited number of cases. Sailer et al.<sup>(7)</sup> reported a 41% accuracy in T2 tumors that often attributed to peritumoral tumor infiltration. Garcia-Aguilar et al.<sup>(5)</sup> reported a 70% accuracy in T3 tumors with a 28% overstaging rate.

Although there was a high accuracy of ERUS in assessing the depth of the tumor invasion, there were conditions that affected the accuracy including peritumoral inflammation by tumor or post-irradiation, tumor hemorrhage, microscopic infiltration of cancer cells, tangential scanning rather than scanning at 90 degrees to the rectal wall, and the tendency of the examiner to overstage the depth of tumor invasion.

The previously reported accuracy of ERUS in determining nodal involvement ranged from 55% to 90%<sup>(8,9)</sup> with a sensitivity of 61% to 85%<sup>(10,11)</sup> and specificity of 53% to 91%.<sup>(10,12)</sup> Their findings were similar to our data that shows the accuracy of 73%

with sensitivity of 77%, specificity of 70%, positive predictive value of 67% and negative predictive value of 79%. The accuracy of ERUS in nodal staging may be influenced by the difficulty to distinguish the benign nodes from malignant nodes, and only peritumoral or perirectal node detection.

Although EUS is acceptable in accuracy, sensitivity and specificity in assessing the tumor invasion (uT) and nodal involvement (uN), ERUS still has limitations to stenotic or inaccessible tumors. There are also limitations in the use of ERUS differentiating benign nodes from malignant, and it cannot be used to assess distant metastases.

Despite of some limitations that influence the accuracy, ERUS is a rational, convenient tool with acceptable accuracy for preoperative rectal tumor staging, thus helping surgeons to determine the appropriate treatment modalities.

## REFERENCES

1. Hildebrandt U, Feifel G. Preoperative staging of rectal cancer by intrarectal ultrasound. *Dis Colon Rectum* 1985;28:42-6.
2. Beynon J, Mortensen NJ, Foy DM, Channer JL, Rigby H, Virjee J. Preoperative assessment of mesorectal lymph node involvement in rectal cancer. *Br J Surg* 1989;76:276-9.
3. Frascio F, Giacosa A. Role of endoscopy in staging colorectal cancer. *Semi Surg Oncol* 2001;20:82-5.
4. Wong WD. Transrectal ultrasound: accurate staging for rectal cancer. *J Gastrointest Surg* 2000;4:338-9.
5. Garcia-Aguilar J, Pollack J, Lee SH, Hernandez de Anda E, Mellgren A, Wong WD, Finne CO, Rothenberger DA, Madoff RD. Accuracy of endorectal ultrasonography in preoperative staging of rectal tumors. *Dis Colon Rectum* 2002;45:10-5.
6. Heintz A, Buess G, Frank K, Kuntz C, Strunck H, Junginger T. Endoluminal ultrasonic examination of sessile polyps and early carcinomas of the rectum. *Surg Endosc* 1989;3:92-5.
7. Sailer M, Leppert R, Bussen D, Fuchs KH, Thiede A. Influence of tumor position on accuracy of endorectal ultrasound staging. *Dis Colon Rectum* 1997;40:1180-6.
8. Blomqvist L, Machado M, Rubio C, Gabrielsson N, Granqvist S, Goldman S, Holm T. Rectal tumor staging: MR imaging using pelvic phased-array and endorectal coils vs endoscopic ultrasonography. *Eur Radiol* 2000; 10:653-60.
9. Kuntz C, Kienle P, Buhl K, Glaser F, Herfarth C. Flexible endoscopic ultrasonography of colonic tumors: indications and results. *Endoscopy* 1997;29:865-70.
10. Boyce GA, Sivak MV Jr, Lavery IC, Fazio VW, Church

- JM, Milsom J, Petras R. Endoscopic ultrasound in the pre-operative staging of rectal carcinoma. *Gastrointes Endosc* 1992;38:468-71.
11. Kaneko K, Boku N, Hosokawa K, Ohtsu A, Fujii T, Koba I, Oda Y, Muro K, Miyake I, Yoshida S, Abe K. Diagnostic utility of endoscopic ultrasonography for pre-operative rectal cancer staging estimation. *Jpn J Clin Oncol* 1996;26:30-5.
  12. Norton SA, Thomas MG. Staging of rectosigmoid neoplasia with colonoscopic endoluminal ultrasonography. *Br J Surg* 1999;86:942-46.

## 內視鏡直腸超音波在直腸腫瘤術前分期和其病理分期比較

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**背景：** 直腸腫瘤臨床術前分期對外科醫師在治療診斷上是很重要的。其中內視鏡直腸超音波為一種常用的工具。本研究依據手術標本之病理分期為基準分析ERUS在臨床術前分期的準確度。

**方法：** 共67位直腸腫瘤病患，其術前ERUS分期和術後病理組織做分析比較。

**結果：** 比對手術原有病理報告的腫瘤深達度，ERUS在術前腫瘤深度側量準確度為88%。高估為9%，低估為3%，腫瘤周圍淋巴腺預測其準確度為73%，敏感度77%，專一度70%。

**結論：** 用於直腸腫瘤術前分期ERUS是一種具有客觀，方便，和高準確性的工具。因而可幫助外科醫師判斷適合的治療方式。

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**關鍵字：** 術前分期，直腸腫瘤，內視鏡直腸超音波。

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