A tertiary care hospital's 10 years' experience with rectal ultrasound in early rectal cancer

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ABSTRACT

Background and Objectives: Rectal endoscopic ultrasound (RUS) has become an essential tool in the management of rectal adenocarcinoma because of the ability to accurately stage lesions. The aim of this study was to identify the staging agreement of early RUS-staged rectal adenocarcinoma with surgical resected pathology and ultimately determine how this impacts the management of early rectal cancer (T1–T2). **Methods:** Retrospective chart review was performed from November 2002 to November 2013 to identify procedure indication, RUS staging data, surgical management, and postoperative surgical pathology data. **Results:** There were a total of 693 RUS examinations available for review and 282 of these were performed for a new diagnosis of rectal adenocarcinoma. There was staging agreement between RUS and surgical pathology in 19 out of 20 (95%) RUS-staged T1 cases. There was staging agreement between RUS and surgical pathology in 3 out of 9 (33%) RUS-staged T2 cases. There was significantly better staging agreement for RUS-staged T1 lesions compared to RUS staged T2 lesions ($P = 0.002$). Nearly 60% of T1N0 cancers were referred for transanal excisions (TAEs), and 78% of T2N0 cancers underwent low anterior resection. **Conclusions:** This study identified only a small number of T1–T2 adenocarcinomas. There was good staging agreement between RUS and surgical pathology among RUS-staged T1 lesions whereas poor staging agreement among RUS-staged T2 lesions. Although TAE is largely indicated by the staging of a T1 lesion, this approach may be less appropriate for T2 lesions due to high reported local recurrence.

Key words: Endoscopic ultrasound, local excision, low anterior resection, rectal cancer, transanal endoscopic microsurgery

INTRODUCTION

Colorectal cancer is the third most common cancer in America and the second leading cause of cancer death.[1] It is estimated 30%–40% of colorectal cancers arise from the rectum.[2] The prognosis of rectal cancer is strongly dependent on the stage (tumor + nodes) at the time of initial presentation.[3] Several imaging modalities have been studied in the initial staging of rectal cancer including endoscopic ultrasound (EUS). The accuracy of EUS in T staging rectal cancer has shown to range from 74% to 94%, compared to magnetic resonance imaging (MRI) (75%–85%)

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and computed tomography (CT) (65%–75%).[4-9] The accuracy of EUS for N staging has been less precise ranging from 63% to 86% and has been shown to be not significantly different from MRI and CT.[4-10]

Sensitivity of advanced lesions using EUS has been found to be higher than in early T stage (T1 87.8%, T2 80.5%, T3 96.4%, T4 95.4%).[11] EUS sensitivity when compared to MRI and CT has been found to be similar in T1 and T2 tumors but significantly higher in T3 tumors.[12] EUS specificity when compared to MRI has been shown to be higher in T1 and T2 tumors (86% *vs.* 69%).[12]

Low anterior resection (LAR) with total mesorectal excision (TME) after chemoradiation with or without sphincter preservation is the standard surgical approach for advanced rectal cancer, whereas local excision (LE) such as transanal endoscopic microsurgery (TEM) is reserved for small, highly selected rectal cancers (T1N0). LE has been shown to have adequate oncologic outcomes for patients with T1 tumors with most comparisons to TME showing no difference in local recurrence or 5 years survival.[13,14] However, LE of T2 tumors has shown to have a higher risk of local recurrence when compared to TME.[14] According to the practice parameters of the American Society of Colon and Rectal Surgeons, T1 tumors <3 cm in diameter and occupying less than a third of the circumference of the bowel lumen can be considered for LE.[15] Patients with T2 tumors are recommended to undergo LAR.[16]

We sought to identify staging agreement of early rectal ultrasound (RUS)-staged rectal adenocarcinoma with surgical pathology and determine how this impacts management of early rectal cancer (T1–T2) at our institution.

METHODS

Patients were identified through an institutional review board approved endoscopic database that included all individuals undergoing RUS from November 2002 to November 2013 at our institution. A retrospective chart review was performed to identify procedure indication, RUS staging, surgical management, postoperative surgical pathology, and patient outcomes. There were four endosonographers at our institution performing RUS, and all completed a fellowship in advanced endoscopy. A radial echoendoscope (Olympus Radial GF-UE160, Olympus of America, Center Valley, PA)

was used. Patients who underwent RUS received an oral preparation, and conscious sedation was used. Tumor stage was classified using the American Joint Commission on Cancer TNM staging system.[17] Inclusion criteria were patients undergoing RUS for suspicion of rectal polyp, mass, cancer, or ulcer. Exclusion criteria included those who underwent RUS for restaging of disease and evaluation of recurrence. Descriptive analysis was performed, and statistical differences between two groups were assessed using the log-rank test.

RESULTS

Between November 2002 and November 2013, there were 693 RUS examinations performed at our institution [Table 1]. 443 examinations were performed for the evaluation of rectal polyp, polypectomy site, mass, or ulcer [Figure 1]. 282 (41%) RUS examinations

Table 1. Indications for rectal ultrasound

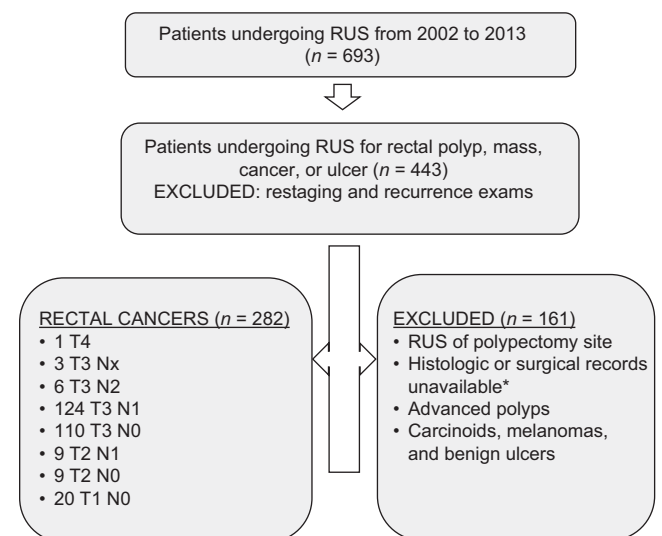| Reason for examination	*n* (%)
Extrinsic compression	41 (5.9)
Fistula	9 (1.3)
Hemorrhoids	2 (0.3)
Incontinence	56 (8.1)
Rectal or anal pain	3 (0.4)
Submucosal lesions	40 (5.8)
Anal cancer	24 (3.5)
Rectal polyp, polypectomy site, mass or ulcer	443 (63.8)
Cancer restaging	29 (4.2)
Cancer recurrence	46 (6.6)
Total examinations	693

Figure 1. Data selection for rectal adenocarcinoma. *13 T1N0 and 6 T2N0 cancers were excluded from data analysis due to lack of available postoperative histological and surgical data

were performed for a new diagnosis of rectal adenocarcinoma. Approximately, 10% of all rectal cancers in our study were staged as either uT1N0 [Figure 2a and 2b] or uT2N0 [Figure 2c and 2d] using RUS [Figure 1]. There were 33 uT1N0 and 15 uT2N0 lesions identified by RUS. However, surgical and postoperative histological data were only available for 20 uT1N0 and 9 uT2N0 examinations. There were only one T1N1 and four T2N1 lesions in our study that we did have postoperative data for, however, were excluded from our study given positive node status. The mean distance from the anal verge was 5.9 cm and 7.9 cm for pT1N0 and pT2N0 cancers, respectively [Table 2]. RUS agreement with pathology was 95% for T1N0 and 33% for T2N0 cancers [Table 3]. Surgical stage for the sole patient with staging disagreement with uT1N0 cancer was pT2N0. Surgical stage for all patients with staging disagreement with uT2N0 cancer was pT1N0. There was significantly greater staging agreement for T1N0 lesions than T2N0 cancers ($P = 0.002$). None of the T1N0 lesions identified by RUS had nodal involvement on surgical pathology.

Surgical data for T1N0 and T2N0 cancers are also depicted in Table 3 with 60% undergoing transanal excision (TAE) for uT1N0 lesion and one patient for uT2N0 cancer. Nearly 15% underwent TEM for uT1N0 cancers where was only one patient underwent TEM for uT2N0 cancer. 15% of uT1N0 cancers and 78% of uT2N0 cancers were treated with LAR, respectively. The reasons for two patients undergoing TAE and TEM for RUS staged T2N0 cancer instead of LAR were secondary to age and comorbidities as
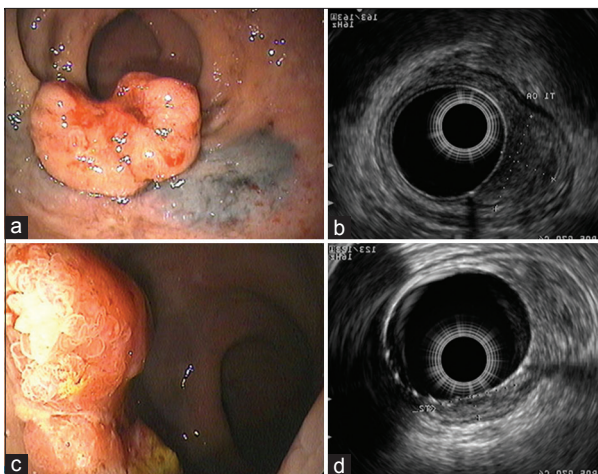

Figure 2. Endoscopic and rectal ultrasound appearance of T1N0 and T2N0 cancer. (a) T1 N0 cancer endoscopic appearance. (b) T1 N0 rectal ultrasound staging demonstrating submucosal invasion. (c) T2 N0 cancer endoscopic appearance. (d) T2 N0 rectal ultrasound staging with invasion in the muscularis propria

well patient preference to avoid LAR. This approach is not standard of care for T2N0 lesions. None of the T2 lesions identified on RUS had positive nodes postoperatively.

Mean follow-up for uT1N0 and uT2N0 cancer were 46.6 and 44.2 months, respectively [Table 4]. There were six and three deaths in the uT1N0 and uT2N0 cancer group, respectively during follow-up. One patient had a recurrence in the uT1N0 group and two in the uT2N0 group. The patient who had a recurrence with uT1N0 cancer underwent TEM during the initial surgical intervention. The sole patient who underwent TEM for uT2N0 cancer also had a recurrence.

DISCUSSION

EUS has been used extensively for staging rectal cancer with specificity and sensitivity of RUS dependent on the stage at the time of diagnosis. Our results

Table 2. Baseline characteristics of T1N0 and T2N0 cancers

	pT1N0 (*n*=20)	pT2N0 (*n*=9)
Male:female ratio	14:6	5:4
Mean age±SD (years)	64.3±15.7	62±12
Mean distance from anal verge±SE of the mean (cm)	5.9±1.0	7.9±1.7
Mean diameter±SE of the mean (cm)	2.8±0.3	3.2±0.5
Mean time to surgery±SE of the mean (days)	35±8.1	22±4.9

SE: Standard error, SD: Standard deviation

Table 3. Surgical outcomes for T1N0 and T2N0 cancers

	T1N0(*n*=20)	T2N0(*n*=9)
Agreement with pathology (%)	19 (95)*	3 (33.3)†
Surgical intervention		
TAE	12	1
TEM	3	1
LAR	3	7
Total proctocolectomy	1	-

*The one patient with staging disagreement had T2N0 cancer postoperatively, †All patients with staging disagreement had T1N0 cancer postoperatively. TAE: Transanal excision, TEM: Transanal endoscopic microsurgery, LAR: Low anterior resection

Table 4. Follow-up and recurrence for T1N0 and T2N0 cancers

	T1N0 (*n*=20)	T2N0 (*n*=9)
Mean follow-up (months±SD)	46.6±6.5	44.2±7.6
Recurrence	1*	2*
Mortality	6	3

*One patient underwent TEM during initial surgical intervention. SD: Standard deviation, TEM: Transanal endoscopic microsurgery

corroborate the utility of RUS in early rectal cancer with strong staging agreement of T1N0 lesions. Only one T1N0 lesion was staged inaccurately by RUS with surgical pathology demonstrating a T2N0 lesion. T2N0 lesions, however, demonstrated poor staging agreement between RUS and surgical pathology with all cases of disagreement secondary to over staging by RUS. The specificity of RUS increases as the staging of rectal cancer increases; however, up to 45% of T2N0 rectal cancers can be inaccurately staged.[18] The main limitations of RUS in T staging is over staging T2 as T3 lesions.[19] In this study, all instances of disagreement between RUS staging and surgical pathology occurred secondary to over staging surgical T1N0 cancers as T2N0 by RUS. One of the limitations of our study is that we cannot identify how may RUS staged T3N0 cancers were pathologically T2 cancers because it likely would have necessitated preoperative chemoradiation which has been shown to decrease the sensitivity and specificity of RUS staging.[20] It is thought over staging of T2 lesions through RUS is secondary to peritumoral inflammation that is difficult to distinguish from neoplastic tissue on EUS.[19] As such, we can only comment on the agreement of RUS staging with surgical specimens and not the accuracy of RUS in early rectal cancer. This study confirms the usefulness of RUS in T1N0 lesions as well as limitations of RUS staging of T2N0 lesions.

There are few randomized controlled trials comparing TAE and TEM although it does appear TEM is superior in terms of visualization and resection of higher lesions with local recurrence varying from 7% to 21% for T1 lesions and 26% to 47% for T2 lesions.[15] Our study demonstrates the recurrence rate of TEM being lower for T1N0 cancers than T2N0 lesions. As such, LE is considered an appropriate treatment modality for carefully selected T1 rectal cancers without high-risk features.[15] EUS in early cancer facilitates surgical planning, however, we require trials with large sample sizes and follow-up to fully elucidate recurrence rates as well as to define the role of EUS in neoadjuvant chemoradiation.

Limitations of our study include the inherent limitations of a retrospective analysis as well exclusion of a number of T1N0 and T2N0 cancers secondary to the absence of histological and surgical data. The involvement of lymph nodes was not studied as errors in nodal staging would result in an overall staging error and the sensitivity of RUS in assessing nodal involvement is known to be limited compared to MRI. We chose to analyze the utility of RUS in T1 and T2 lesions only and determine if surgical pathology corroborated our findings. This study demonstrated that none of the T1N0 and T2N0 lesions determined by RUS demonstrated nodal involvement on surgical pathology. In addition, our study was not designed to compare inter-observer variability and given the sample size of T1N0, and T2N0 lesions studied, the variance of staging agreement between endosonographers would not achieve statistical significance. However, staging agreement of our endosonographers of RUS-staged T1N0 and T2N0 cancers ranged between 89%–100% and 0%–66%, respectively. This is in concordance with previous studies which demonstrate reduced agreement in staging T2 lesions via RUS.[19]

CONCLUSIONS

RUS has shown evidence of high staging agreement with surgical pathology for uT1N0 lesions and allows for TEM to be pursued without evidence of increased rates of recurrence. Unfortunately, uT2N0 lesions staged via RUS may lead to TME although surgical pathology demonstrates a pT1N0 lesion. As such, other imaging modalities in combination with RUS may be required for higher T stages to increase sensitivity and specificity and guide appropriate surgical intervention and neoadjuvant chemoradiation.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Kim HG, Moon JS, Cho HW. Esophagus and mediastinum. In: KSGE EUS Committee, editor. Textbook of Endoscopic Ultrasonography. Seoul: JIN; 2011. p. 34-63.
2. Samee A, Selvasekar CR. Current trends in staging rectal cancer. *World J Gastroenterol* 2011;17:828-34.
3. Avallone A, Aloj L, Delrio P, *et al.* Multidisciplinary approach to rectal cancer: Are we ready for selective treatment strategies? *Anticancer Agents Med Chem* 2013;13:852-60.
4. Kocaman O, Baysal B, Sentürk H, *et al.* Staging of rectal carcinoma: MDCT, MRI or EUS. Single center experience. *Turk J Gastroenterol* 2014;25:669-73.
5. Savides TJ, Master SS. EUS in rectal cancer. *Gastrointest Endosc* 2002;56 4 Suppl: S12-8.
6. Zhu J, Huang PT, Ding KF, *et al.* Clinical value of radial endorectal ultrasound in the assessment of preoperative staging of rectal carcinoma. *Zhonghua Zhong Liu Za Zhi* 2013;35:148-53.
7. Golfieri R, Giampalma E, Leo P, *et al.* Comparison of magnetic

resonance (0,5 T), computed tomography, and endorectal ultrasonography in the preoperative staging of neoplasms of the rectum-sigma. Correlation with surgical and anatomopathologic findings. *Radiol Med* 1993;85:773-83.

8. Ho ML, Liu J, Narra V. Magnetic resonance imaging of rectal cancer. *Clin Colon Rectal Surg* 2008;21:178-87.

9. Marone P, de Bellis M, D'Angelo V, *et al*. Role of endoscopic ultrasonography in the loco-regional staging of patients with rectal cancer. *World J Gastrointest Endosc* 2015;7:688-701.

10. ASGE Standards of Practice Committee, Fisher DA, Shergill AK, *et al*. Role of endoscopy in the staging and management of colorectal cancer. *Gastrointest Endosc* 2013;78:8-12.

11. Gleeson FC. EUS in rectal cancer. In: Hawes RH, Fockens P, Varadarajulu S, editors. Endosonography. Philadelphia: Elsevier Saunders; 2015. p. 260-8.

12. Bipat S, Glas AS, Slors FJ, *et al*. Rectal cancer: Local staging and assessment of lymph node involvement with endoluminal US, CT, and MR imaging – A meta-analysis. *Radiology* 2004;232:773-83.

13. Winde G, Nottberg H, Keller R, *et al*. Surgical cure for early rectal carcinomas (T1). Transanal endoscopic microsurgery vs. anterior resection. *Dis Colon Rectum* 1996;39:969-76.

14. Lee W, Lee D, Choi S, *et al*. Transanal endoscopic microsurgery and radical surgery for T1 and T2 rectal cancer. *Surg Endosc* 2003;17:1283-7.

15. Monson JR, Weiser MR, Buie WD, *et al*. Practice parameters for the management of rectal cancer (revised). *Dis Colon Rectum* 2013;56:535-50.

16. Garcia-Aguilar J, Shi Q, Thomas CR Jr., *et al*. A phase II trial of neoadjuvant chemoradiation and local excision for T2N0 rectal cancer: Preliminary results of the ACOSOG Z6041 trial. *Ann Surg Oncol* 2012;19:384-91.

17. Edge SB, Byrd DR, Compton CC, *et al.*, editors. AJCC Cancer Staging Manual. 7th ed. New York: Springer; 2010. p. 237-46.

18. Ahuja NK, Sauer BG, Wang AY, *et al*. Performance of endoscopic ultrasound in staging rectal adenocarcinoma appropriate for primary surgical resection. *Clin Gastroenterol Hepatol* 2015;13:339-44.

19. Colaiácovo R, Assef MS, Ganc RL, *et al.* Rectal cancer staging: Correlation between the evaluation with radial echoendoscope and rigid linear probe. *Endosc Ultrasound* 2014;3:161-6.

20. Frykholm GJ, Glimelius B, Påhlman L. Preoperative or postoperative irradiation in adenocarcinoma of the rectum: Final treatment results of a randomized trial and an evaluation of late secondary effects. *Dis Colon Rectum* 1993;36:564-72.