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SPECIAL SECTION: RECTAL CANCER

Rectal cancer DFP dedicated issue: abdominal radiology

The role of ERUS in staging of primary rectal cancer: a surgeon's perspective

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I use ERUS (endorectal US) and MR as adjunctive to digital rectal examination for assessment of low and mid rectal neoplasms. Notable features on digital rectal examination include distance of the lesion from the anal verge, depth of invasion, and mobility (predicted clear CRM—circumferential radial margin), as well as wall location, size, and percent of involved wall circumference. Furthermore, digital rectal examination is very useful to assess relationship of the lesion to the upper anal sphincter (puborectalis) and pelvic organs immediately adjacent including prostate, seminal vesicles, vagina, and cervix. Whereas clear resection margins are paramount for prevention of local recurrence and cure of cancer, assessment of non-invasion of surrounding organs and structures is paramount for preserving organ function and quality of life.

Of note, digital rectal examination is subjective and observer dependent. In contrast, ERUS and MR provide objective T and N staging and measurement of predicted CRM upon which neo-adjuvant radiation and chemotherapy treatments are recommended. However, a cautionary note is that both ERUS and MR require strict attention to technique in order to provide accurate reading. The ERUS operator must keep the ultrasound crystal centered within the balloon of the probe in order to avoid artifactual over-staging depth of invasion. Similarly, the MR technician must orient the orthogonal plane of imaging to multiple long axes that change in the pelvis, sacral curvature, and anus, also in order to avoid artifactual over-staging depth of invasion. Multiple MR views can compensate for some but not all non-orthogonal artefact.

Diagnostic performance for T stage is similar for ERUS and MR. Reported T stage accuracy for ERUS ranges from 63 to 96% [1, 2]. Pooled sensitivity and specificity in a meta-analysis of ERUS, respectively, are: T1—88%, 98%; T2—81%, 96%; T3—96%, 91%; T4—95%, 98% [2, 3]. MR accuracy for T stage has been reported ranging from 65 to 100% [4] with pooled accuracy of 86% in a meta-analysis with heterogeneity reported from variable T2–T3 designation on "spiculated" extensions from the tumor into the perirectal fat [5, 6].

I use ERUS to assess superficial lesions that may be considered for transanal local excision as possible definitive treatment of cancer in the absence of lymph node or distant metastases. ERUS may be preferred over MR for T1–T2 lesions [7–9]. Guidelines recommend that histologically favorable T1 lesions can be locally excised as definitive management but that T2 lesions should be resected with radical mesorectal excision [10, 11]. The endorectal probe immediately adjacent to the rectal wall provides excellent resolution of the T1 submucosal interface especially using a higher frequency setting 10–16 MHz [12] Figs. 1, 2.

Also, ERUS has excellent visualization of structures immediately anterior to the rectal wall including vagina, prostate, and seminal vesicles. As such, the anterior CRM may be accurately assessed using ERUS [13, 14]. As mesorectal fat surrounding the rectum becomes thinner in the distal pelvis approaching the pelvic floor, distinction of a clear CRM becomes more difficult for both MR and ERUS. Because the focus of the ultrasound probe is directly adjacent to the bowel wall, ERUS provides excellent detailed images of the distal anterior rectal wall and anal component structures Figs. 3, 4. In contrast, ERUS does not consistently identify lateral and posterior mesorectal fascia. As such, measurement of CRM predicted margins in these locations are best assessed using MR. However, ERUS can assess CRM clearance for T3a lesions in lateral and posterior locations by finding uninvolved fat radial to these smaller but locally invasive lesions. Free mobility on digital rectal examination supports prediction of clear CRM.

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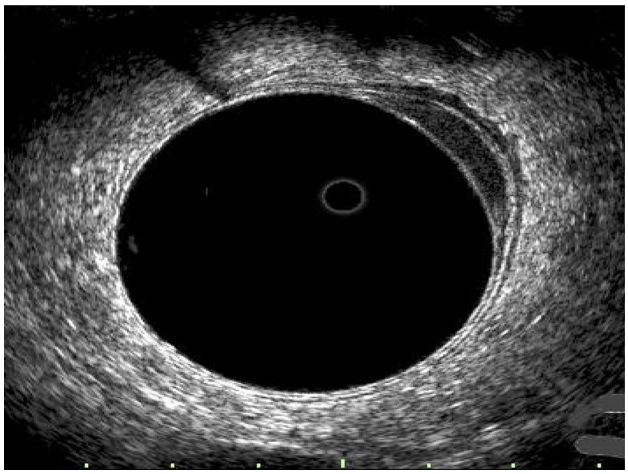

Fig. 1 T1 lesion showing intact submucosal interface

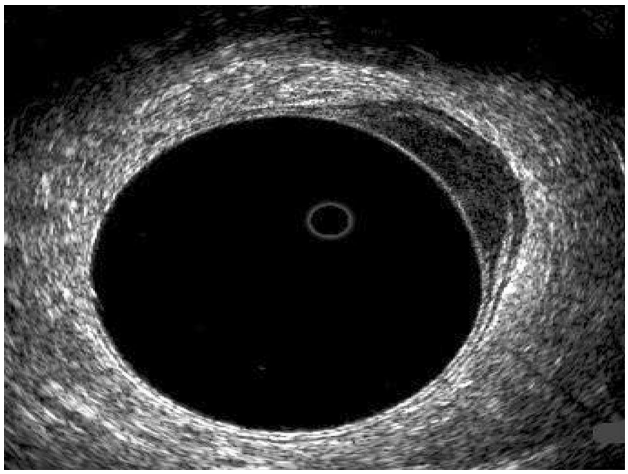

Fig. 2 T2 lesion showing involved submucosal interface

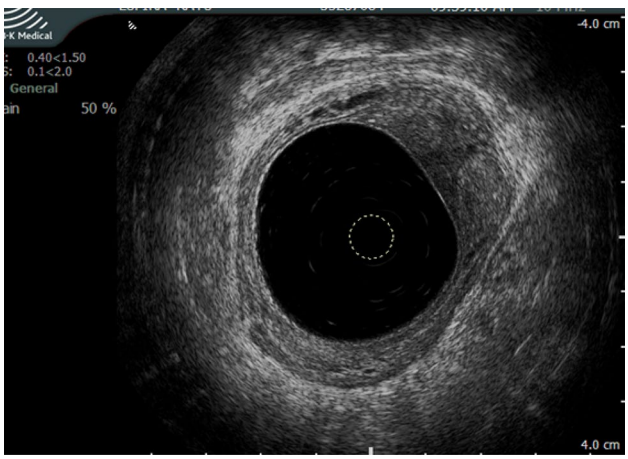

Fig. 3 Anterior lesion showing narrow but intact anterior CRM

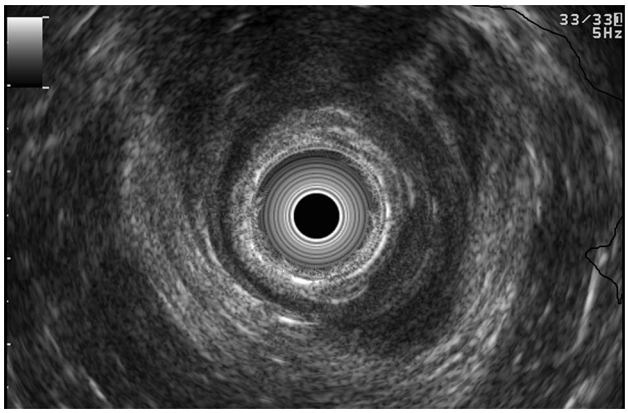

Fig. 4 Posterior lesion involving puborectalis sling

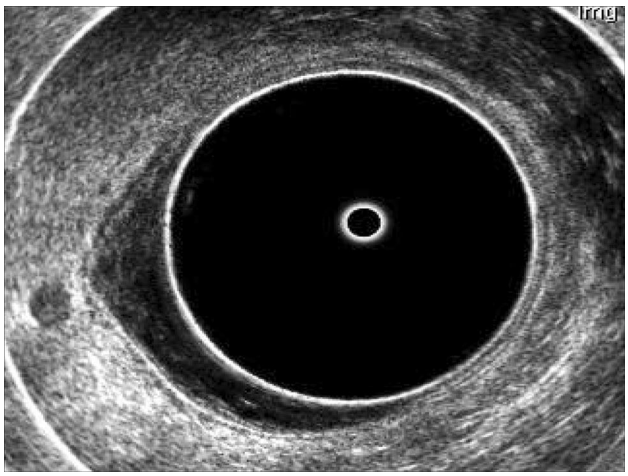

Fig. 5 Lymph node with malignant features—spherical shape, irregular border, mixed echogenicity

ERUS can also identify lymph nodes in the mesorectum at mid and distal rectal levels. Lymph nodes greater than 1 mm can be seen and characterized as having characteristics of benign or malignant nodes. Current MR guidelines designating lymph node diameter as metastatic are changing with 50% of metastatic nodes having size less than 5 mm in diameter. Both MR and ERUS can assess features of benign nodes with smooth borders, oval shape, uniform echogenicity or features of metastatic cancer with irregular borders, more rounded shape, or mixed echogenicity (Fig. 5). ERUS does not assess extra-mesorectal internal iliac lymph nodes.

Rectal assessment by ERUS is limited by stenosing lesions where the probe cannot pass through the lesion to accurately assess full extent of invasion. As well, there is discomfort to the patient as the rigid ERUS probe is advanced upward inside the curvature of the mid and upper sacrum. The discomfort may limit assessment of lesions in upper mid and upper rectum. Lesions invading anal muscles

and perianal skin can be painful and may prevent passage of the ERUS probe. Neoadjuvant radiation can also cause pain and prevent passage of the probe through the anus that can prevent assessment of post-radiation down-staging.

MR is limited by presence of implanted hardware (pacemaker, cochlear implants, metal in eyes, metal in artificial orthopedic joints/plates), gurney weight limitation, and claustrophobia.

Summary

MR technology has improved significantly and has replaced ERUS as the standard initial imaging modality for rectal cancer (ref guidelines European Society of Gastrointestinal and Abdominal Radiology, Society of Abdominal Radiology, American Society of Colon and Rectal Surgeons, NCCN). At this time, I use ERUS and digital rectal examination to provide complimentary assessment for rectal cancer staging for superficial lesions being considered for local excision, and, for lesions of the distal anterior rectal wall and that approach the upper anal sphincter where there is consideration of en bloc resection of anterior organs and anal sphincter.

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