The use of endoscopic ultrasonography and other imaging modalities in the preoperative staging of rectal villous tumours: A case of overstaging by magnetic resonance imaging

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A case of a 60-year-old man with recurrent rectal villous adenoma is described. Preoperative staging with endoscopic ultrasound (EUS) and magnetic resonance imaging (MRI) revealed very discordant results. EUS showed a tumour present in the mucosa with no submucosal invasion, while MRI revealed invasion of the muscularis propria consistent with an invasive stage T2 carcinoma. Based on the MRI findings, the patient underwent a low anterior resection of the tumour. The surgical pathology specimen revealed a villous adenoma with low-grade dysplasia but no carcinoma and no extension into the muscularis propria. The present case highlights the uncertainty that currently exists as to which imaging modality provides the greatest accuracy in the staging of rectal cancer and in guiding the type of surgical procedure performed. Two recent meta-analyses and a systematic review of the literature point to EUS as the imaging modality of choice for determining muscularis propria and perirectal tissue invasion, as well as nodal involvement.

Key Words: Endoscopic ultrasound; MRI; Rectal cancer; Staging

CASE PRESENTATION

A 60-year-old man who underwent colonoscopy was found to have a 2 cm sessile polyp that was located 10 cm from the anal verge and successfully removed. The polyp was a tubulovillous adenoma with focal high-grade dysplasia. A flexible sigmoidoscopy performed three months later, as well as a repeat colonoscopy one year after the initial colonoscopy, were both negative for recurrence.

A colonoscopy performed three years after the initial colonoscopy revealed a sessile polyp, 3 cm in size, at 10 cm from the anal verge. Biopsies were taken and reported to be fragments of a villous adenoma with low-grade dysplasia. Due to the previous high-grade dysplasia, relatively rapid recurrence and concern that a cancer may have been missed by sampling error, a pelvic magnetic resonance imaging (MRI) scan and an endoscopic ultrasound (EUS) were performed before definitive excision. The MRI revealed an invasive rectal mass involving the muscularis propria but without breach of the adventitia, consistent with a T2 rectal carcinoma (Figure 1). No pelvic lymphadenopathy was detected. The EUS revealed a rectal mass involving the mucosa and submucosa, with no involvement of the mus-

L'utilisation de l'endoscopie et d'autres modalités d'imagerie dans la classification préopératoire de tumeurs vilieuses rectales : Un cas de surclassification par imagerie par résonance magnétique

Le cas d'un homme de 60 ans atteint d'un adénome vilieux rectal est présenté. La classification préopératoire par endoscopie (ES) et l'imagerie par résonance magnétique (IRM) ont donné des résultats très incompatibles. L'ES a révélé une tumeur de la muqueuse sans invasion de la sous-muqueuse, tandis que l'IRM a révélé une invasion de la couche externe évocatrice d'un carcinome envahissant de stade T2. Compte tenu des résultats de l'IRM, le patient a subi une résection antérieure basse de la tumeur. L'échantillon pathologique chirurgical a donné un résultat d'adénome vilieux avec dysplasie bénigne, sans carcinome et sans empiètement dans la couche externe. Le présent cas fait ressortir l'incertitude actuelle quant à la modalité d'imagerie la plus précise pour classer le cancer rectal et orienter le type d'intervention chirurgicale à privilégier. Deux récentes méta-analyses et analyses bibliographiques systématiques laissent penser que l'ES est la modalité d'imagerie de choix pour déterminer une invasion de la couche externe et des tissus périrectaux, ainsi qu'une atteinte ganglionnaire.

Figure 1) Postcontrast T1 axial magnetic resonance image revealing the rectal lesion with invasion of the muscularis propria (white arrows) without breach of the adventitia, consistent with a T2 rectal carcinoma

cularis propria (Figure 2). The results of the MRI and EUS, as well as the surgical versus endoscopic resection treatment

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Figure 2) Endoscopic ultrasound image of the rectal lesion (white arrowheads) involving the mucosa and submucosa, with no invasion of the muscularis propria (black arrows)

options, were discussed with the patient, who opted for a surgical resection.

The patient underwent a low anterior resection and end-to-end anastomosis with loop ileostomy. Pathology review of the resected rectosigmoid revealed a villous adenoma with low-grade dysplasia. There was no evidence of muscularis propria invasion, and a total of five pericolic and two mesorectal lymph nodes were excised and deemed benign. The patient underwent ileostomy reversal five months later. He remains asymptomatic with no recurrence of tumours.

DISCUSSION

Rectal cancer is the third most common malignancy in the western world, and is the second most common cause of cancer deaths (1,2). Surgical excision is the primary treatment modality and because local recurrence after resection is associated with a poor prognosis, much attention has been focused on determining the best diagnostic and treatment strategies to optimize local control of the primary tumour (3).

Surgical excision of rectal cancer consists of either transanal local excision, endoscopic microsurgery or total mesorectal excision. The stage of the tumour, based on the tumour, node, metastasis classification system (Table 1), impacts heavily on prognosis and determines the type of surgical procedure performed (4,5). Transanal local excision or endoscopic microsurgery are considered for cancers staged at T1 or lower, while total mesorectal excision would be reserved for stages T2 and T3. Thus, accurate preoperative staging of rectal tumours is paramount in guiding the type of surgical procedure performed.

Computed tomography (CT), MRI and EUS have all been used to stage rectal tumours; however, controversy exists as to which diagnostic imaging modality provides the most accurate information. The diagnostic accuracy of these imaging techniques for assessing the depth of tumour invasion, spread to the mesorectal fascia and lymph node involvement has been compared extensively. The findings of the largest and most recent trials are discussed in the present article and are summarized in Table 2.

TABLE 1
Definitions in the American Joint Committee on Cancer tumour, node, metastasis staging system for colorectal cancer

Category	Definition
Primary tumour (T)	
Tis	Carcinoma in situ; intraepithelial or intramucosal carcinoma
T1	Tumour invades submucosa
T2	Tumour invades muscularis propria
T3	Tumour invades through the muscularis propria into the subserosa or into nonperitonealized pericolic or perirectal tissues
T4	Tumour directly invades other organs or structures and/or perforates visceral peritoneum
Regional lymph nodes (N)	
NX	Regional nodes cannot be assessed
N0	No regional nodal metastasis
N1	Metastasis in one to three regional lymph nodes
N2	Metastasis in four or more regional lymph nodes
Distant metastasis (M)	
MX	Distant metastasis cannot be assessed
M0	No distant metastasis
M1	Distant metastasis

Table adapted from the American Joint Committee on Cancer Staging Manual, Sixth Edition (12)

A recent meta-analysis (6) found that EUS, when compared with MRI, overstaged muscularis propria invasion in T1 cancers, while CT and MRI each significantly understaged perirectal tissue invasion for tumours staged at T3 or greater. A second meta-analysis (7) found that EUS was also more effective at identifying nodal status than MRI and CT, although the finding was not statistically significant. Furthermore, only MRI was able to predict circumferential resection margins with accuracy.

Findings from other studies have contradicted these results. Kulinna et al (8) found that multislice CT was more sensitive and specific for delineating rectal wall invasion and perirectal lymph node spread than EUS. To add to the controversy, Chun et al (9) found that phased array 3 Tesla MRI and EUS were equally sensitive and specific for detecting invasion of the muscularis propria and lymph node involvement. However, there was evidence to suggest that EUS was more accurate at determining perirectal tissue invasion. Finally, a recent systematic review of the literature (10) found that EUS was more accurate than MRI at characterizing early localized rectal cancers while MRI was more useful in advanced disease because it provided a clearer definition of the mesorectum and fascia. The authors concluded that EUS and MRI have complementary roles in the assessment of tumour depth.

Taken together, the recent literature seems to indicate that EUS is the modality of choice for staging rectal cancer, although some limitations may exist. The advantages of this modality depend heavily on operator experience, and EUS may be less accurate than MRI in characterizing highly stenotic or proximal tumours and distant metastases (8). On the other hand, advances such as three-dimensional EUS may improve accuracy, and EUS-guided fine-needle aspiration of lymph nodes may further

TABLE 2
Summary of findings of studies comparing diagnostic accuracy of endoscopic ultrasound (EUS), computed tomography (CT) and magnetic resonance imaging (MRI)

Staging parameter	EUS	CT	MRI	P	Author (reference)
Muscularis propria invasion	Sensitivity 94%		Sensitivity 94%	NS	Bipat et al (6)
	Specificity 86%		Specificity 69%	0.02	
	Sensitivity 59%	Sensitivity 82%		<0.05	Kulinna et al (8)
	Specificity 63%	Specificity 84%		<0.05	
	Sensitivity 100%		Sensitivity 100%	NS	Chun et al (9)
	Specificity 61%		Specificity 67%	NS	
	Accuracy 82%		Accuracy 76%		Skandarajah and Tjandra (10)
Perirectal tissue invasion	Sensitivity 90%	Sensitivity 79%	Sensitivity 82%	0.001 (EUS/CT)	Bipat et al (6)
	Specificity 75%	Specificity 78%	Specificity 76%	0.003 (EUS/MRI)	
	Sensitivity 100%		Sensitivity 91%	NS	Chun et al (9)
	Specificity 82%		Specificity 93%	NS	
	Accuracy 0.996		Accuracy 0.938	0.028	
Adjacent organ invasion	Sensitivity 70%	Sensitivity 72%	Sensitivity 74%	NS	Bipat et al (6)
	Specificity 97%	Specificity 96%	Specificity 96%	NS	
Lymph node involvement	Sensitivity 67%	Sensitivity 55%	Sensitivity 66%	NS	Bipat et al (6)
	Specificity 78%	Specificity 74%	Specificity 76%	NS	
	Sensitivity 55%	Sensitivity 75%		<0.05	Kulinna et al (8)
	Specificity 71%	Specificity 85%		NS	
	Sensitivity 58%		Sensitivity 64%	NS	Chun et al (9)
	Specificity 82%		Specificity 92%	NS	
	Diagnostic OR 8.83	Diagnostic OR 5.86	Diagnostic OR 6.53	NS	Lahaye et al (7)
Circumferential resection margins	Diagnostic OR 8.83	Diagnostic OR 5.86	Diagnostic OR 6.53	NS	Lahaye et al (7)
	Specificity NA	Specificity NA	Specificity 92%		Mercury Study Group (13)

NA Not available; NS Not statistically significant

expand the role of this modality in rectal cancer staging. Indeed, EUS has been shown to be helpful in evaluating subepithelial masses and in detecting local tumour recurrence (11).

Although many studies have compared the accuracy of diagnostic imaging modalities for the staging of rectal cancer, it is difficult to draw definitive conclusions from the available literature. Many of the studies are small and vary in study design, patient population, imaging technique and results. Nevertheless, two recent well-conducted meta-analyses and a systematic review of the literature (6,7,10) point to EUS as the imaging modality of choice for determining muscularis propria and perirectal tissue invasion, as well as nodal involvement. EUS and MRI may play complementary roles, with EUS being most accurate for early localized cancers and MRI more useful in assessing advanced cancers (10). In the situation of our patient, in which EUS and MRI reported markedly divergent clinical situations associated with differing prognostic outcomes (ie, noninvasive tumour versus invasive cancer), and given that neither imaging modality has 100% sensitivity and specificity, the patient elected to undergo surgical resection. Similar cases will require individual decision-making regarding risk-benefit and informed consent on the part of the patient.

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