PREOPERATIVE STAGING IN RECTAL CANCER

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Despite potentially curative surgery:

- 30-50% recur
- 1/3 die

BCCA Rectal Cancer Group Guidelines

Clinical Stage 1 (T1, T2, N0, M0)

- Segmental resection. No preop radiation
- Local excision if favorable T1 lesion

Clinical Stage 2 (T3, T4, N0, M0)

- Preop short course radiation
- Segmental resection. Local excision contraindicated

Clinical Stage 3 (any T, N1, N2, N3, M0)

- Managed as for stage 2
- Preop radical preoperative chemoradiation may be indicated

Clinical Stage 4 (any T, any N, M1)

- Excision of primary tumor
- Chemoradiation
- Resection of metastatic lesion
- Fulguration/laser/ endoluminal radiation

RECTAL CANCER STAGING

- **Two consecutive 5 year cohorts of primary rectal cancer surgery.**
- **Periods 1993-1997 and 1998-2002.**
- **Difference between time periods was routine use of pre-operative MR in the second period.**

Eur J Surg Oncol 2005 31(6):681-8

RECTAL CANCER STAGING

- RO resections increased from 92.5 – 97%.
- Lateral tumor free margin of >1mm increased from 84.4 – 92.1%.

RECTAL CANCER STAGING

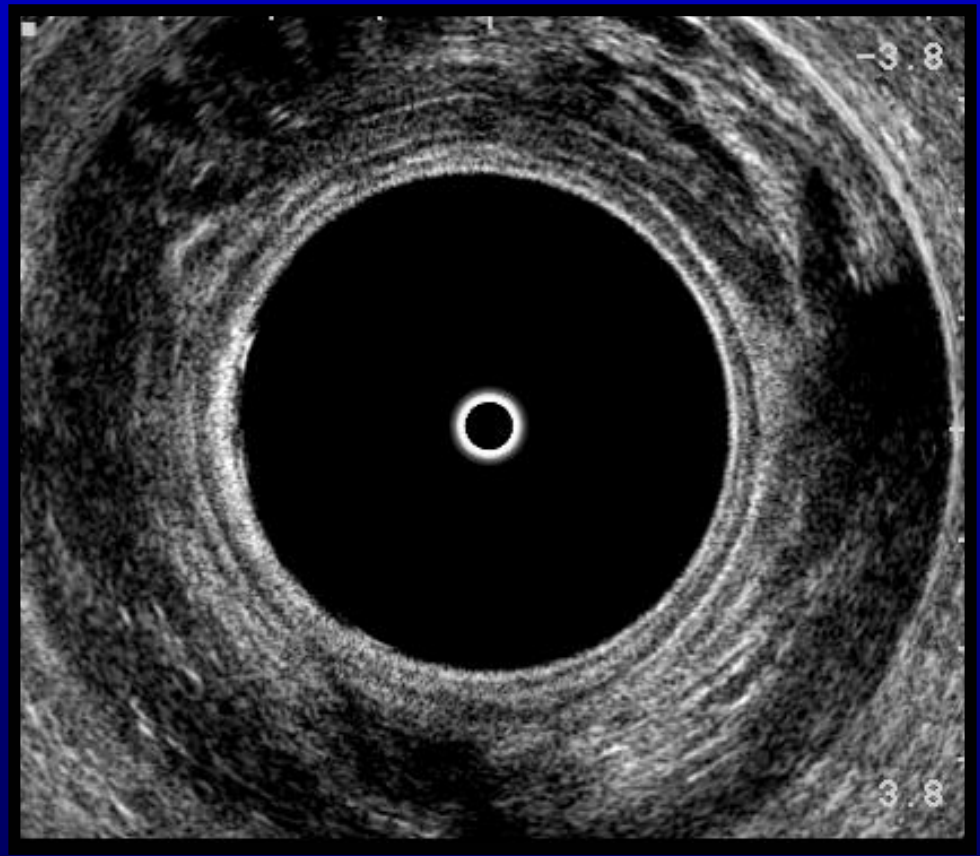
- What imaging modality provides the most accuracy for T and N staging?
- What imaging modality provides the most accuracy for the prediction of tumor invasion of the mesorectal fascia?
- Can we abandon routine CT when endorectal US and MR are available?
- What is the present role for PET/CT?

RECTAL CANCER STAGING

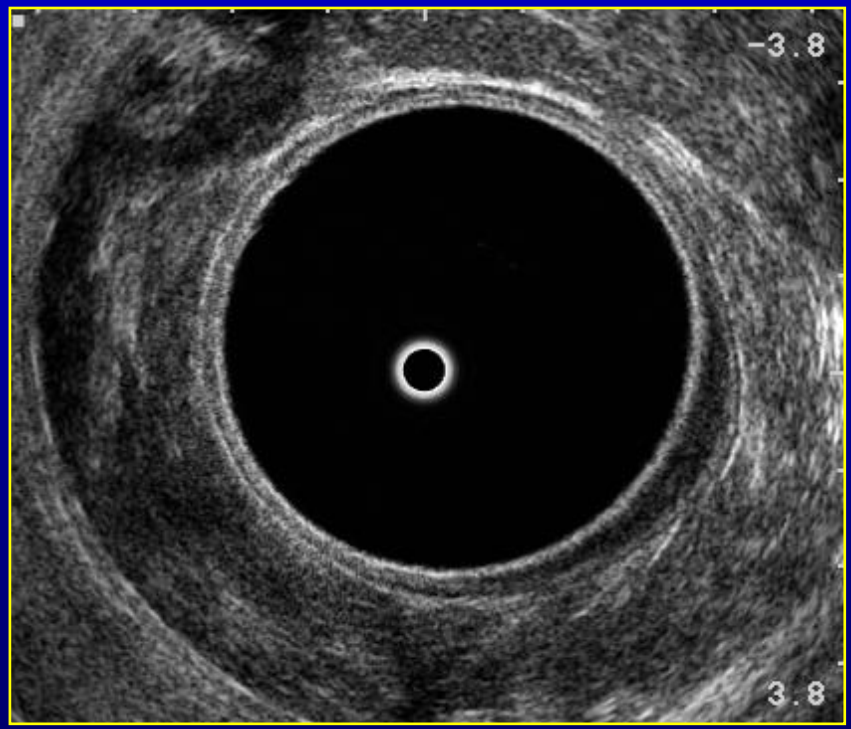
- What imaging modality provides the most accuracy for T staging?

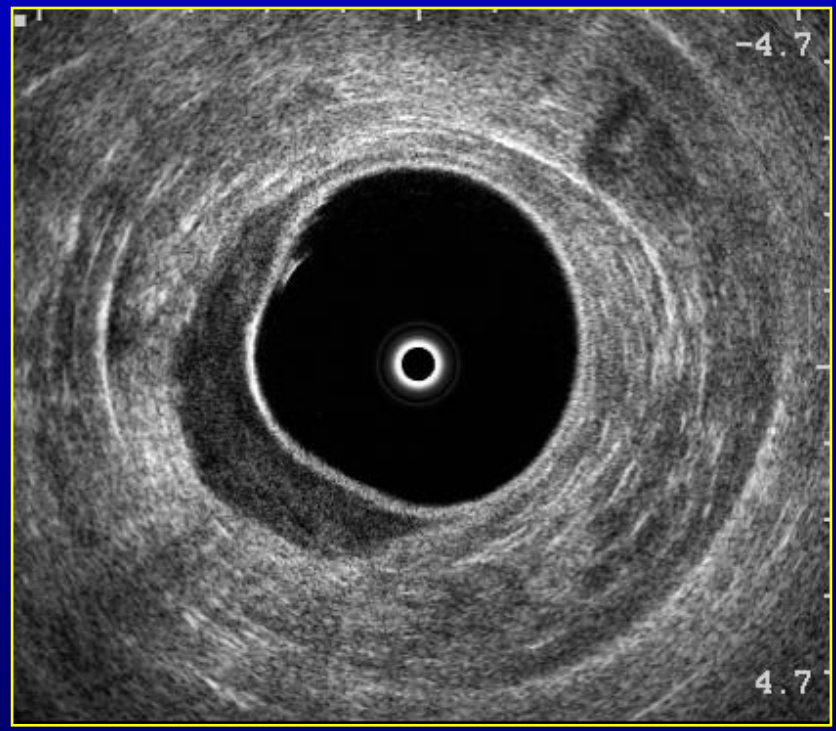
5 Layer Model of Rectal Wall

- Balloon interface with mucosa
- Muscularis mucosa
- Submucosa
- Muscularis propria
- Interface of muscularis propria and pararectal fat



Rectal Cancer





Depth of Tumor Invasion

- Modification of the TNM classification as proposed by Hildebrandt in 1985
- Prefix “u” denotes ultrasound staging

T = Primary Tumor

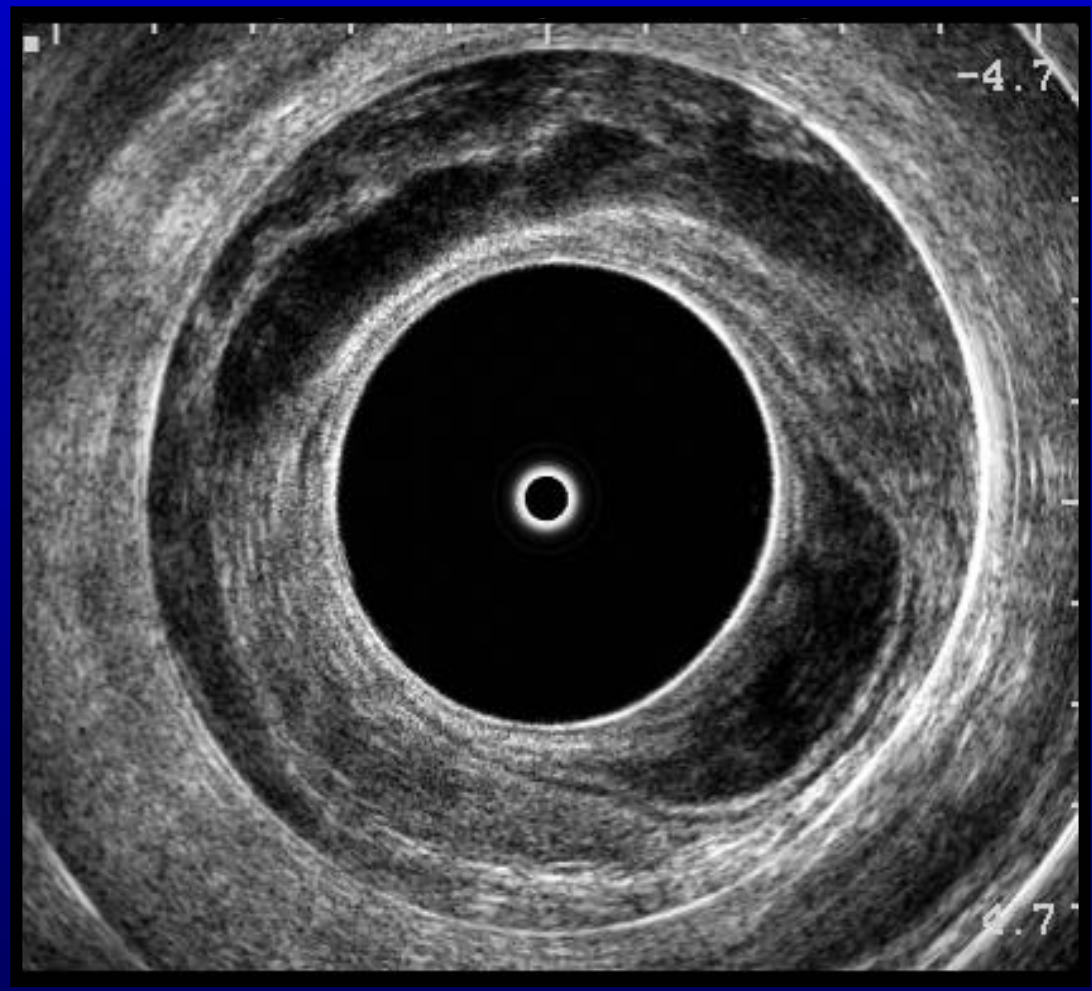
uTO:

- Noninvasive lesion confined to mucosa

T = Primary Tumor

uT1:

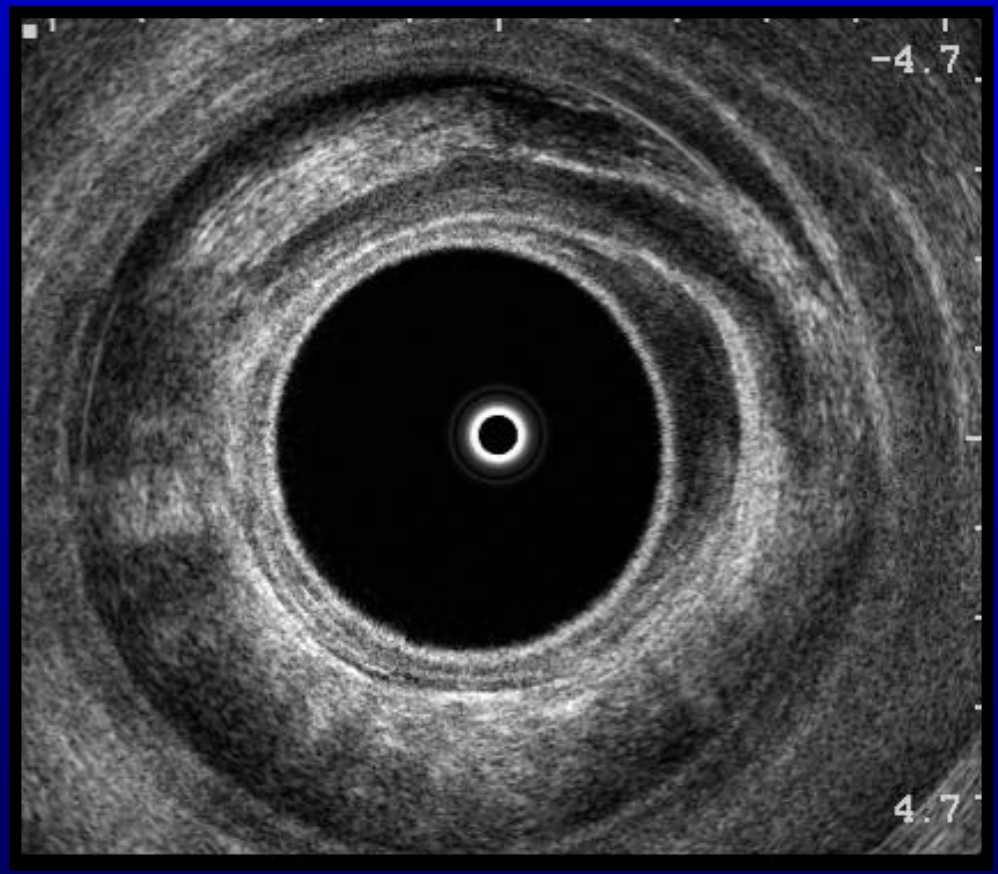
- **Invasive tumor confined to the mucosa and submucosa**



T = Primary Tumor

uT2:

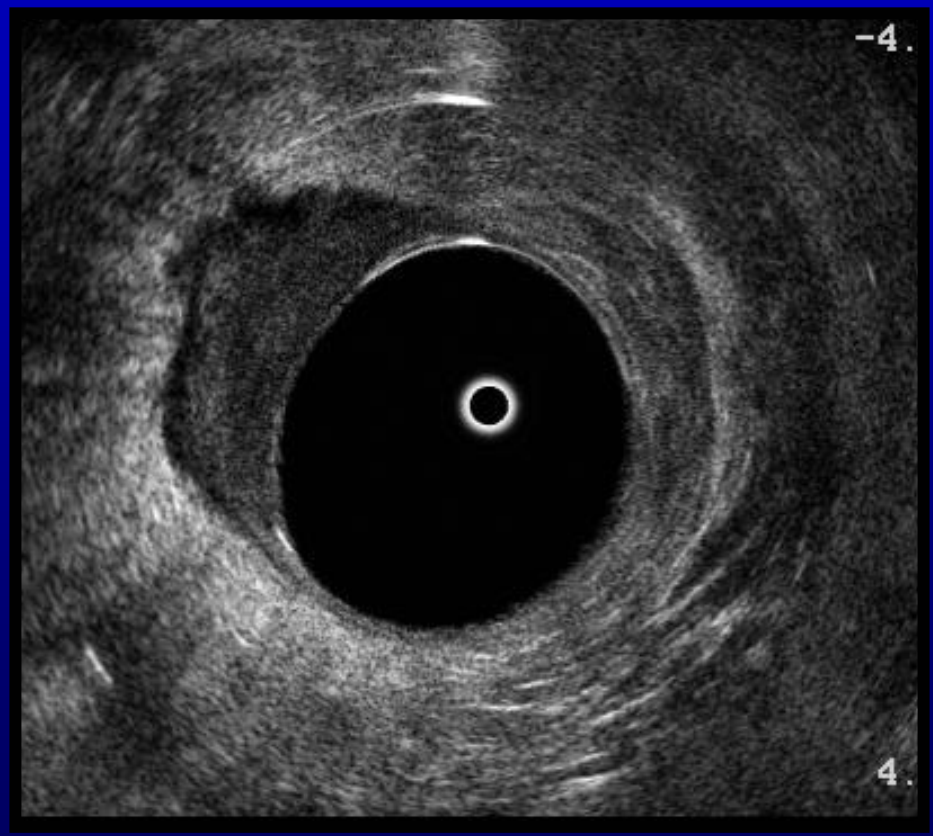
- **Tumor penetrates the muscularis propria but remains confined to the rectal wall**



T = Primary Tumor

uT3:

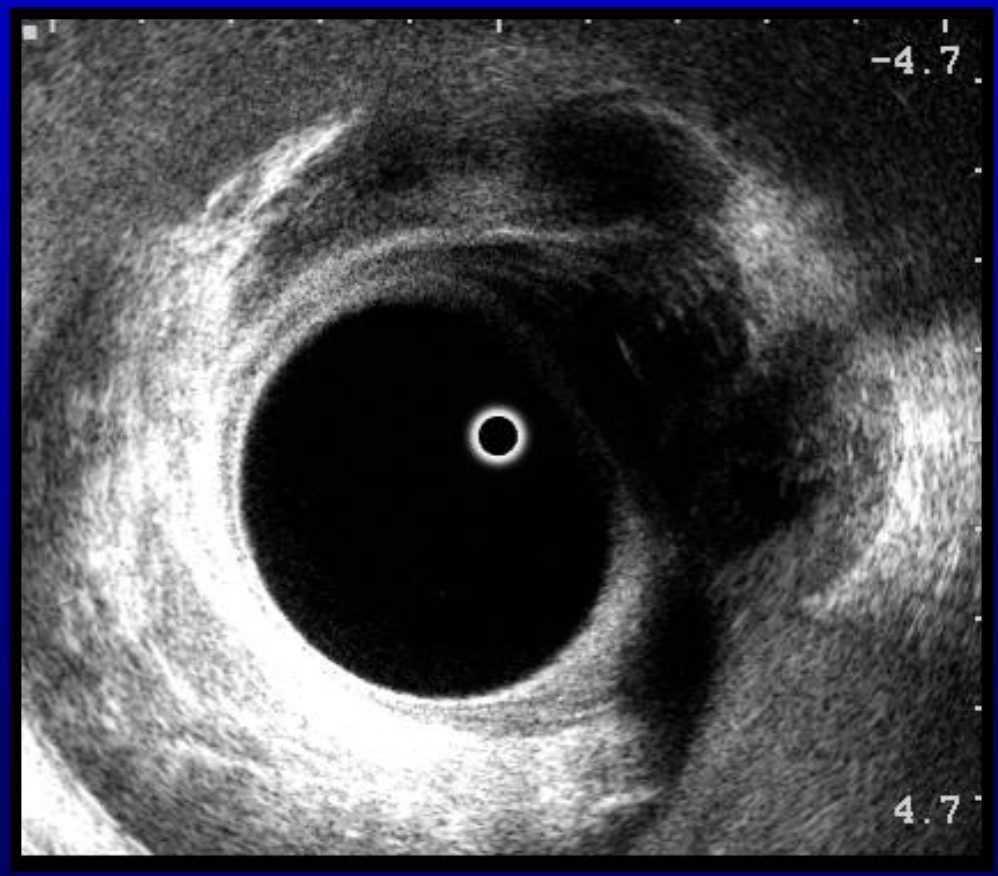
- **Tumor penetrates the entire thickness of the bowel wall and invades the perirectal tissues**

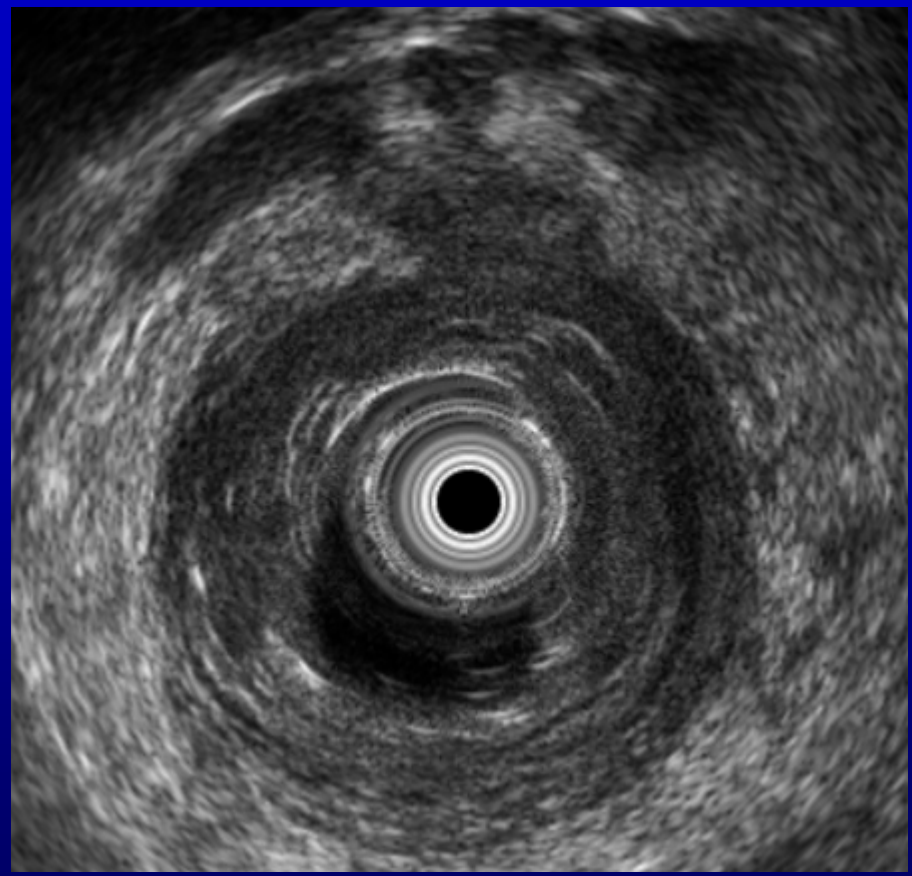


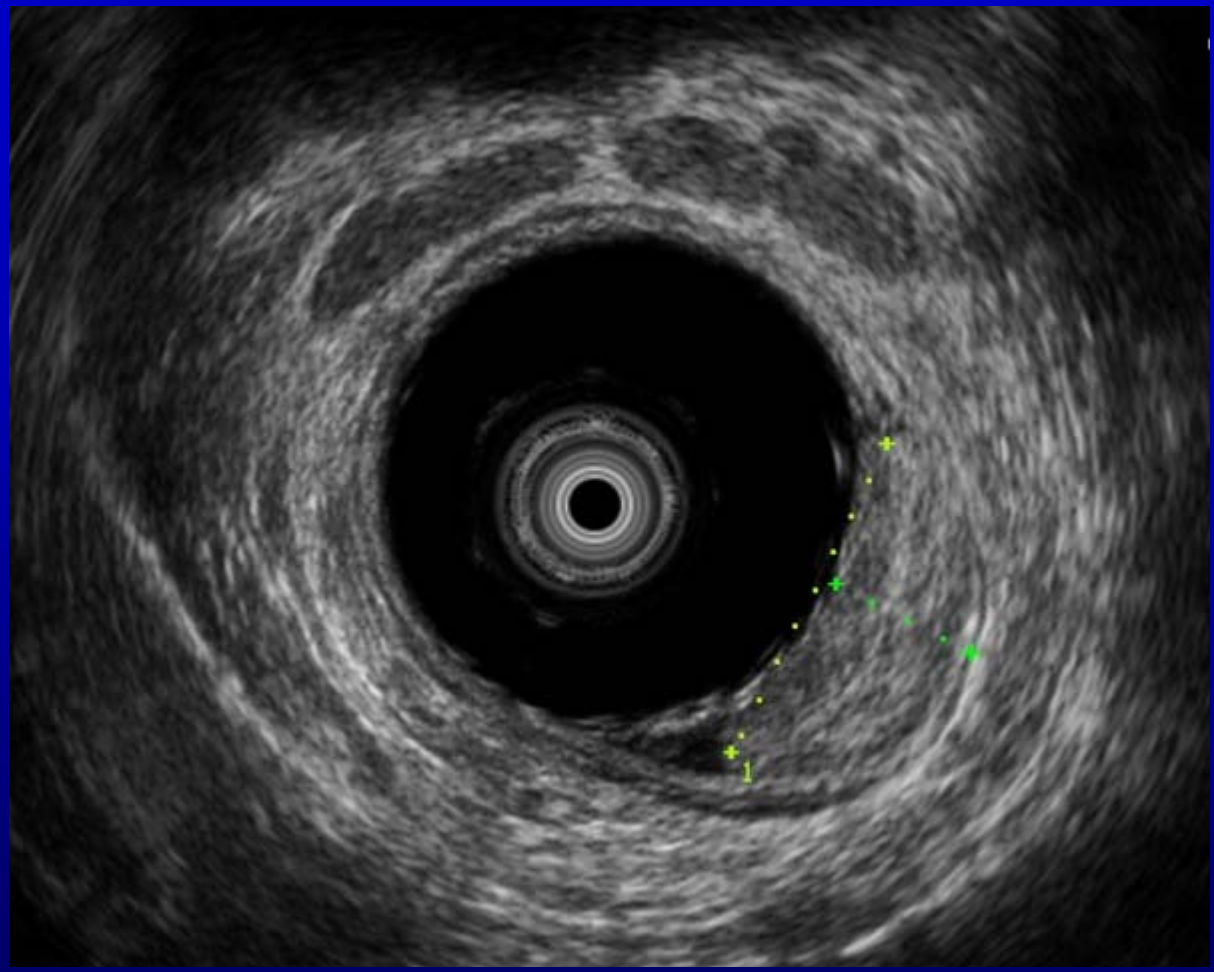
T = Primary Tumor

uT4:

- **Tumor penetrates a contiguous adjacent organ or the pelvic sidewall or sacrum**



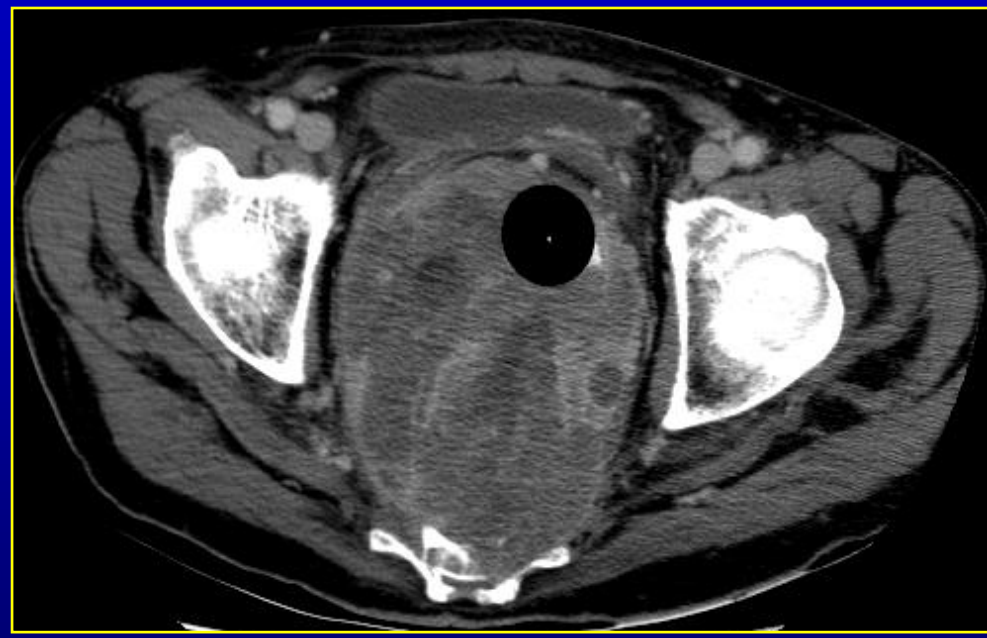




T4 Lesions

MRI found to be superior to CT in the prediction of organ invasion, pelvic wall invasion, and subtle bone marrow invasion.

Abdom Imaging 2000;25:533-541



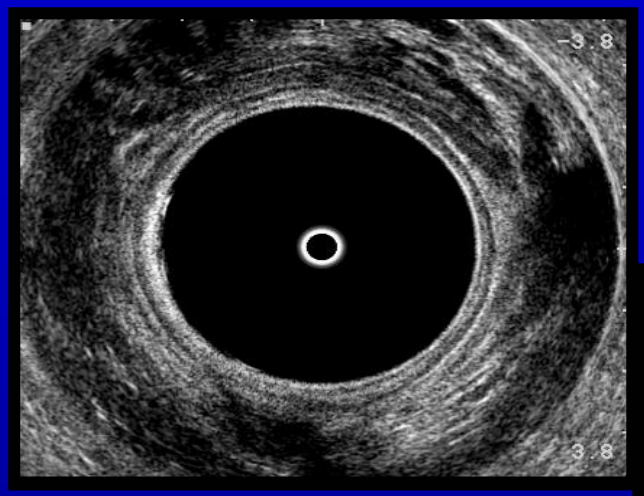
Sacral invasion

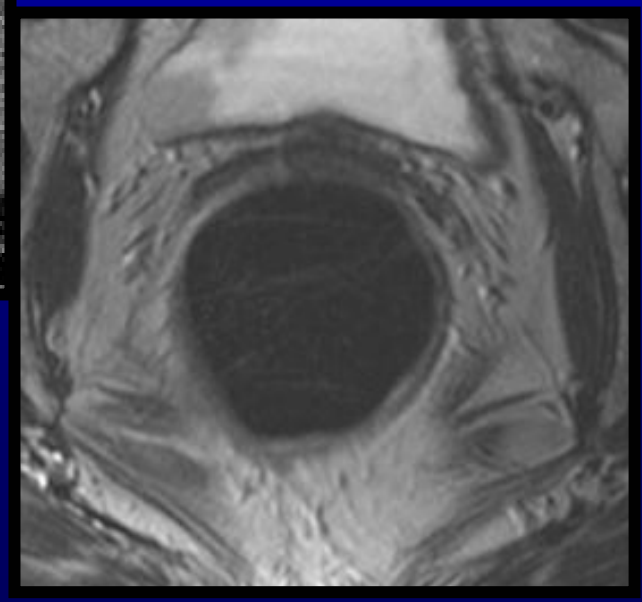
Wall Penetration

	CT	EUS	MRI
Sensitivity	78%	93%	86%
Specificity	63%	78%	77%
Accuracy	73%	87%	82%

Int J Colorectal Dis (2000) 15:9-20

Normal Rectal Wall





RECTAL CANCER STAGING

- **Endorectal US is limited by depth of penetration**

RECTAL CANCER STAGING

- What imaging modality provides the most accuracy for N staging?

N = Regional Lymph Nodes

NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in 1 to 3 regional lymph nodes
N2	Metastasis in 4 or more regional lymph nodes
N3	Metastasis in a lymph node along the course of a named vascular trunk

Nodal Involvement by Tumor

	CT	EUS	MRI
Sensitivity	52%	71%	65%
Specificity	78%	76%	80%
Accuracy	66%	77%	74%

Int J Colorectal Dis (2000) 15:9-20

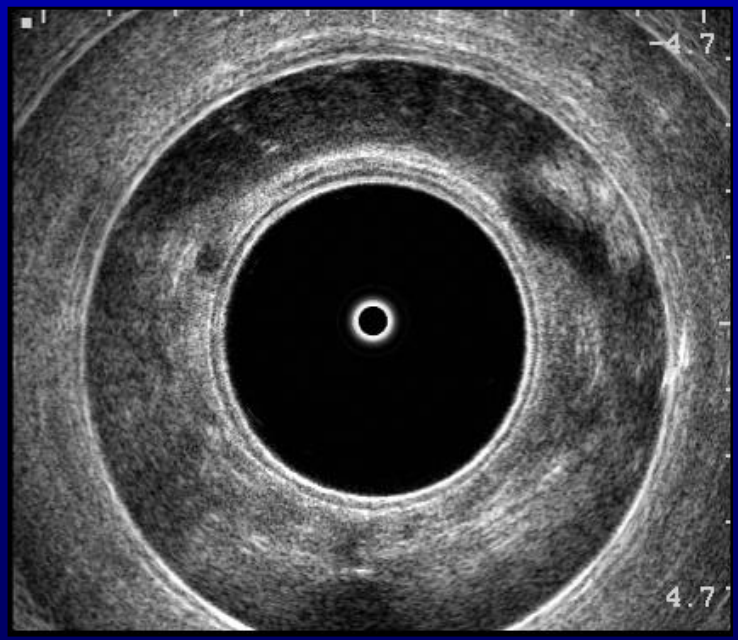
N STAGING

- **Differentiation between inflammatory and malignant nodes is imprecise.**
- **High frequency of micrometastases in normal size nodes in rectal cancer.**

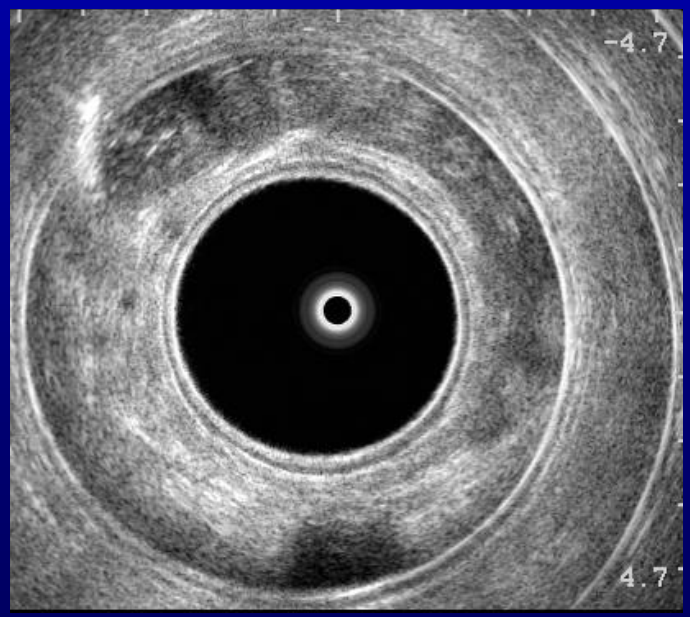
Surg Endos 1989;3(2):96-9

Reliability of imaging modalities for predicting lymph node involvement uncertain

Greater than 5 mm = 50-70%



Smaller than 4 mm = 20 % or less

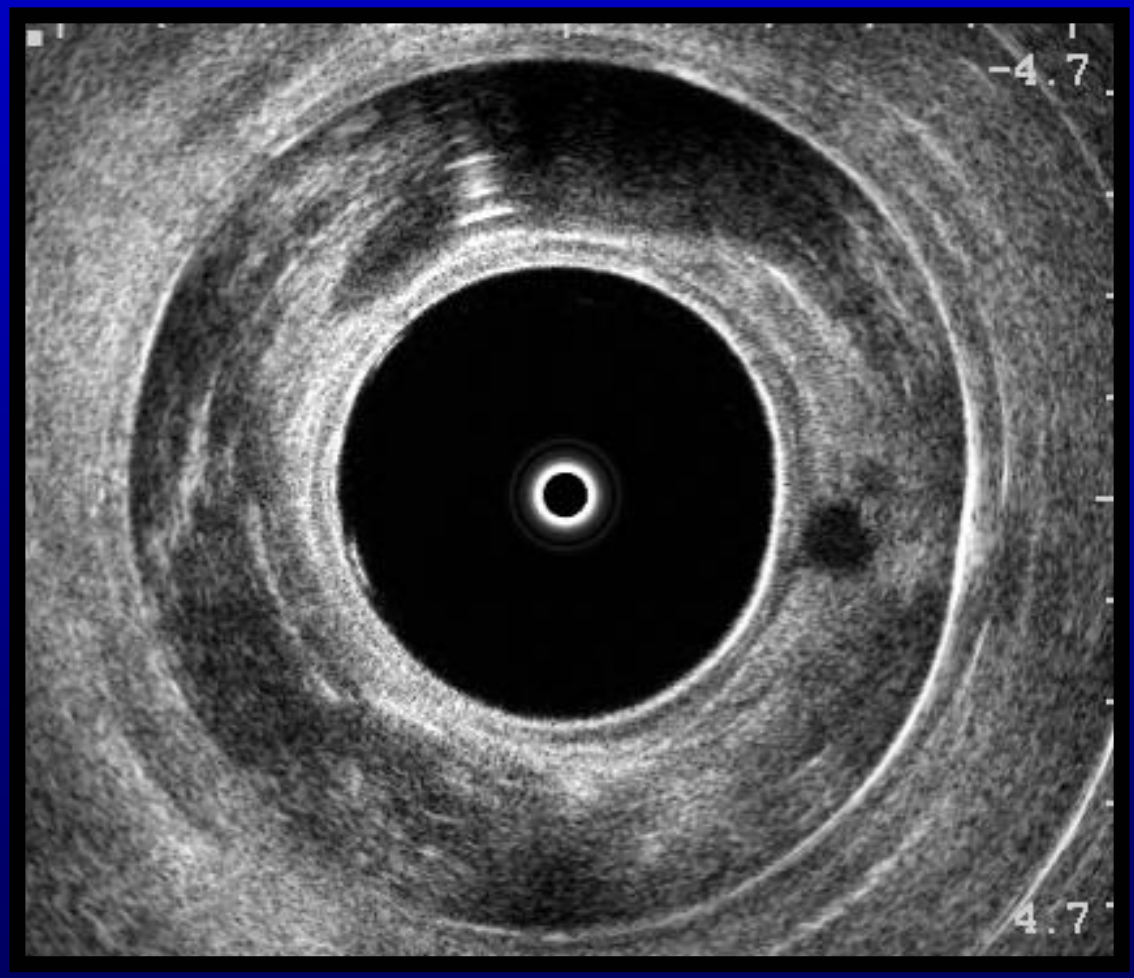


Up to 20% of patients have involved nodes of less than 3mm

Although assessment of T stage is fairly accurate, the assessment of N stage is only moderately effective whatever modality is used.

- **Lack of uniformity for size criteria**
- **Cut off in size not valid**

Regional Lymph Node



N STAGING

- New ironoxide MR contrast agents (USPIO)
- New MR criteria
  - Irregular border
  - Mixed signal intensity

Radiology 2008;246:804-11

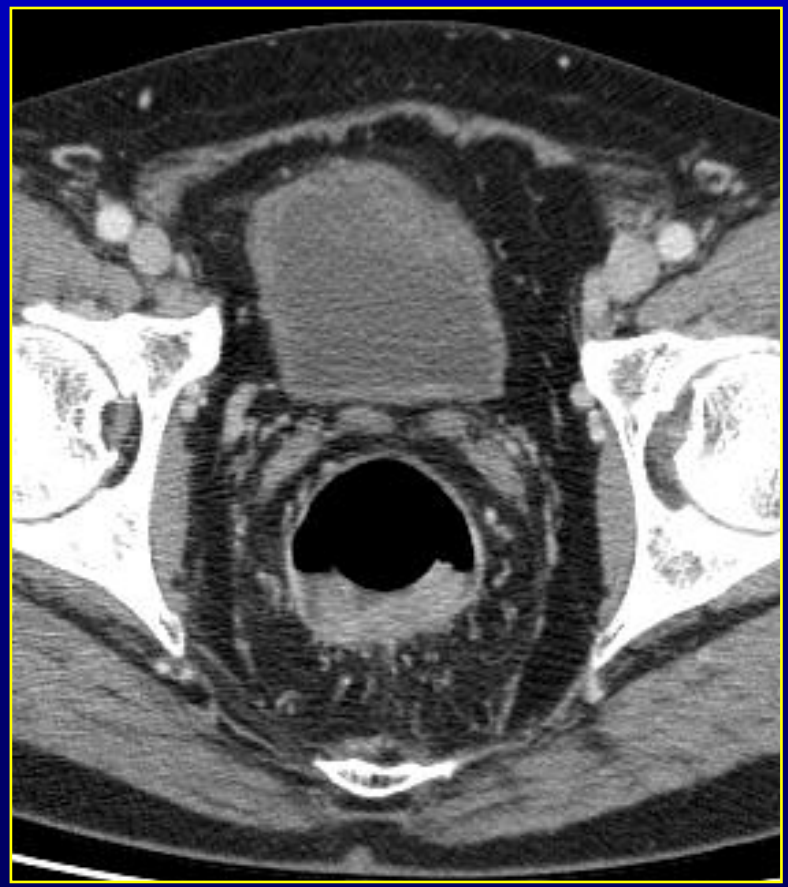
Current TNM staging does not quantify the extent of mesorectal invasion.

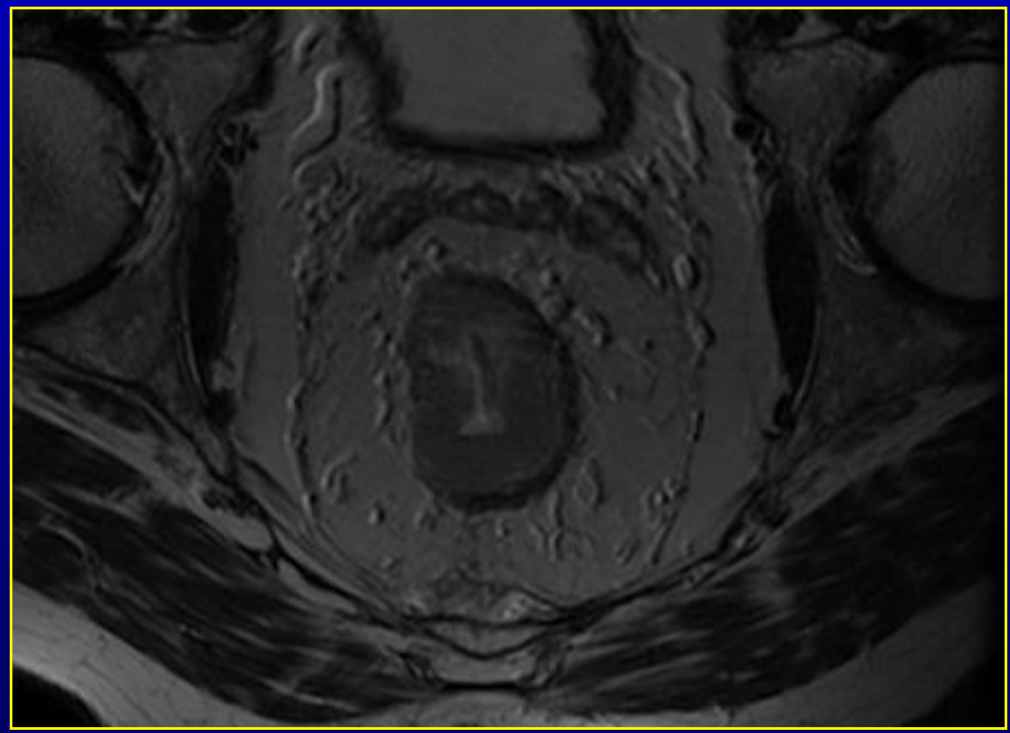
Radiologists, too, are adopting a **CIRCUMFERENTIAL AWARENESS** in our approach to preoperative staging.

RECTAL CANCER STAGING

- **What modality provides the most accuracy for prediction of tumor invasion of the mesorectal fascia?**

Mesorectal Fascia





CRM

- **92 % agreement between MR images and histologic findings in 98 rectal cancer patients.**

British Journal of Surgery 2003;90:355-64

CRM

- **Accuracy of MRI in prediction of tumor-free resection margin in rectal cancer surgery.**

  Lancet 2001;357:497-504

- **Identification of the fascia propria by MRI and its relevance to preoperative assessment of rectal cancer.**

  Dis Colon Rectum 2001;44:259-265

- **Extramural depth of tumor invasion at thin-section MR in patients with rectal cancer: results of the Mercury Study.**

  Radiology 2007; 243(1):132-139

Mesorectal Fascia

CRM

- Prospective study of 38 patients with a mid or low rectal cancer.
- Preoperative MRI.
- TME.

CRM

- 11 mid rectal lesions
  - 100 % agreement between MR and histologic examination
- 27 low rectal lesions
  - 9 anterior (22% agreement)
  - 18 posterior (83% agreement)

Dis Colon Rectum 2005;48:1603-1609

CRM

- **MRI can overestimate the circumferential resection margin involvement in low anterior tumors.**

CRM

- Anterior perirectal fat is usually very thin.
- Low rectum horizontal in position

CRM

- **Conventional CT for the Prediction of an Involved Circumferential Resection Margin in Primary Rectal Cancer**
  - **Conclusion: Lacks sensitivity for a clinical use in preoperative assessment.**

Dig Dis 2007;25:80-85

CRM

- Pilot study for multicentric SPICTRE Study
- 43 patients with rectal cancer
- 3 observers
- Blinded to histogical results
- Assessed distance to mesorectal fascia
- Two categories: <1 or >1 mm
- Histology gold standard

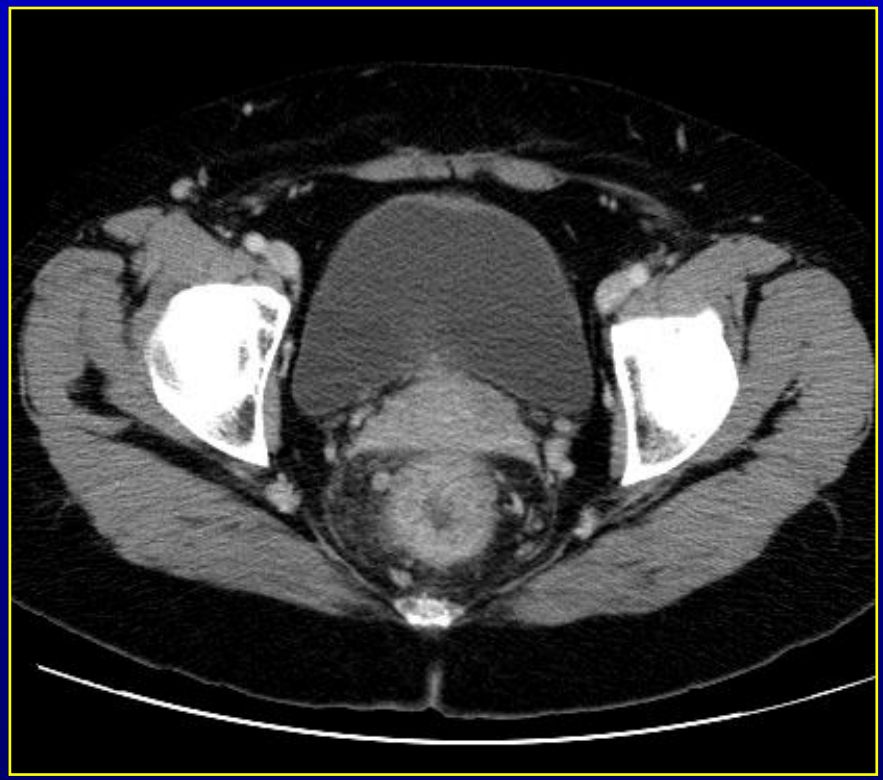
CRM

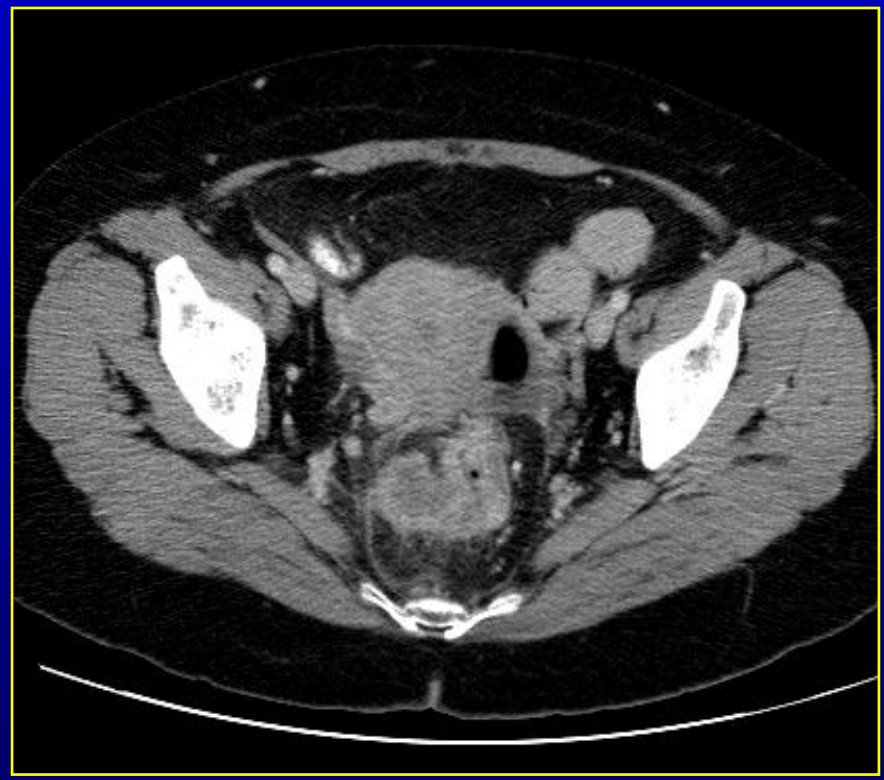
- Total of 129 predictions were made:
  - 26 incorrect (20%)
  - 103 correct (80%)
- Discrepancies occurred in 11 patients
  - Poor quality scans (6)
  - Anteriorly located distal tumor (5)

CRM

- CT has a poor accuracy for predicting MRF invasion in low-anterior located tumors. The accuracy of CT significantly improves for tumors in the mid-high rectum.

CRM





- **Despite major progress in image quality, CT is still limited by its poor soft tissue contrast resolution.**

CRM

- MRI is presently considered the best imaging tool for the assessment of the circumferential resection margin.
- If MRI is unavailable, CT may be adequate for tumors in the proximal or mid rectum.
- MRI should be performed for all tumors in the distal rectum, particularly if located anteriorly.

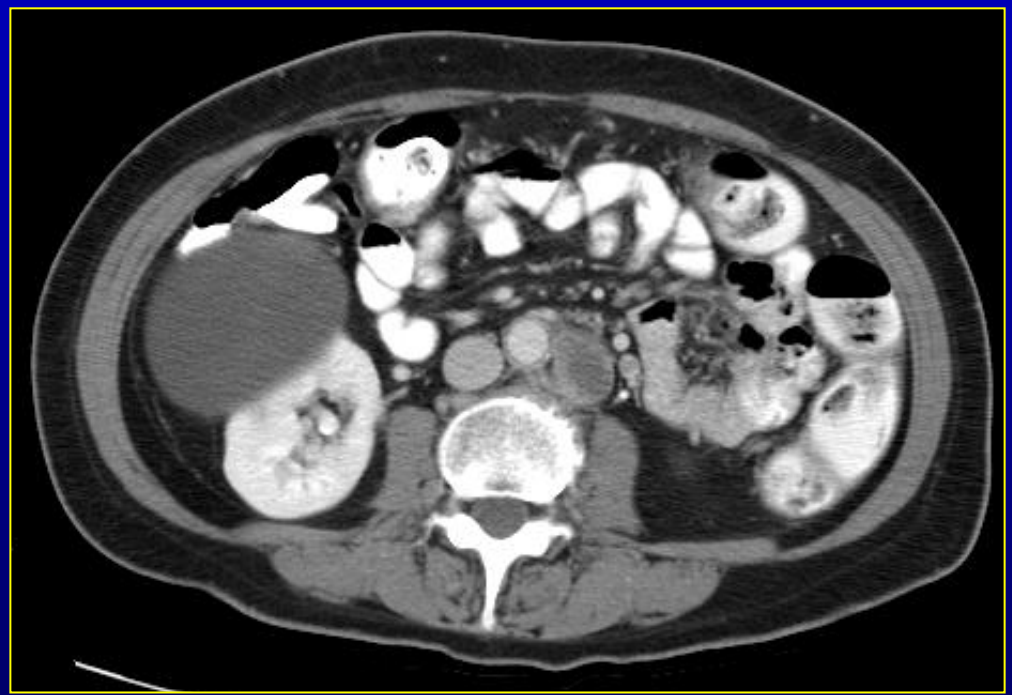
CRM

EUS has little to offer as it is limited by its depth of penetration.

- **Can we abandon routine CT of the abdomen and pelvis when endorectal US and high resolution MRI are available?**

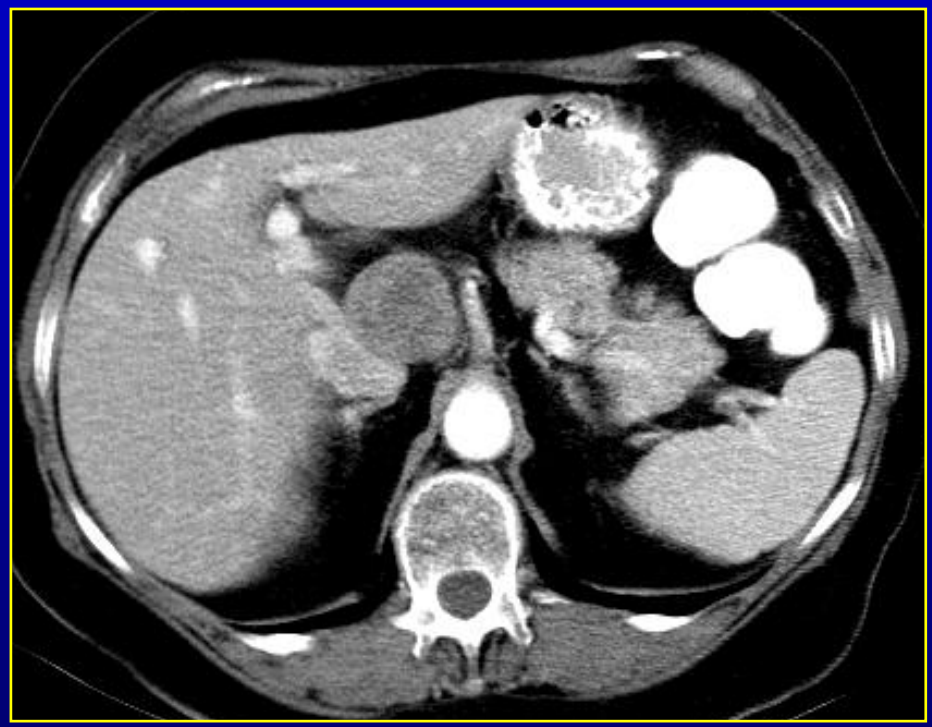
Extramesorectal Lymphadenopathy

Enlarged left external iliac node

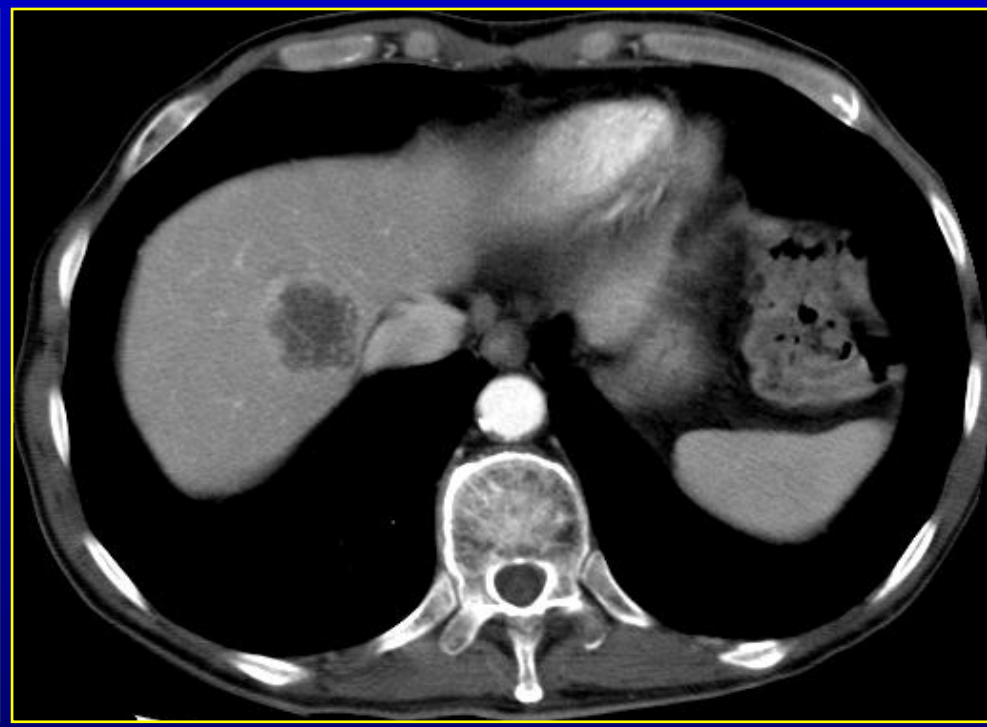


Enlarged left paraaortic node

Distant Metastases



Enlarged portocaval node



Liver metastasis

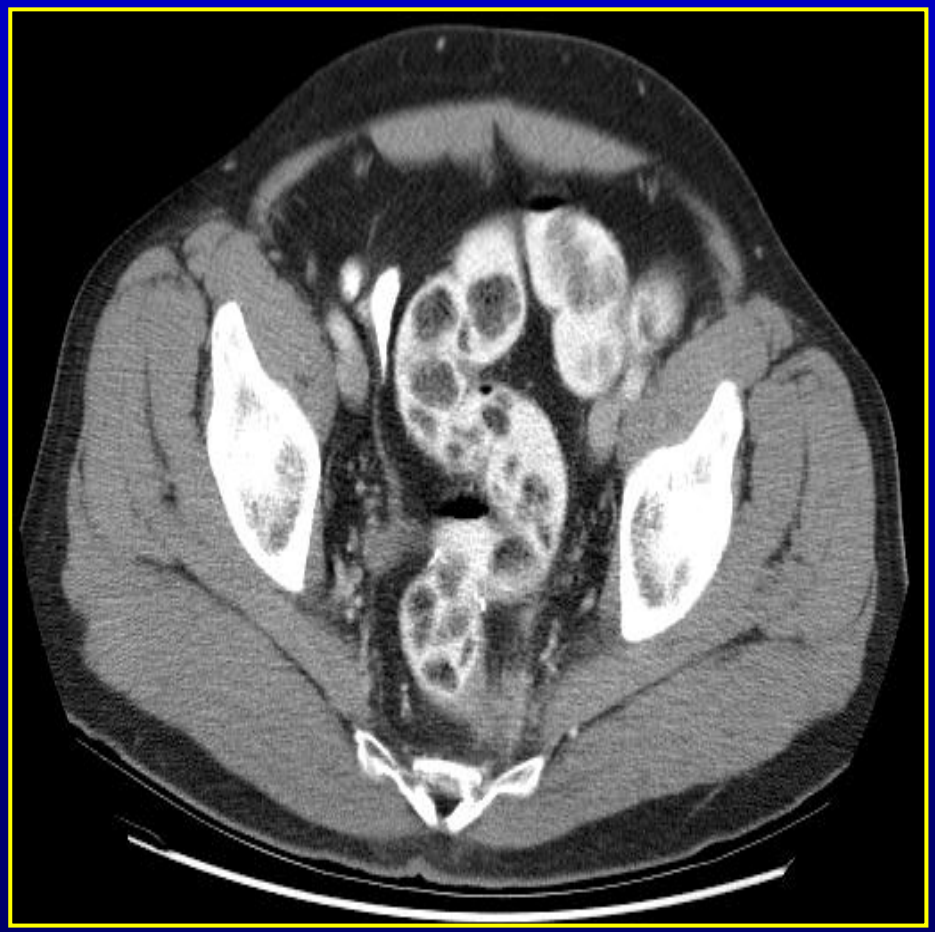
PET/CT

- Has not been systematically assessed as a staging tool for rectal cancer
- Highly likely that it will have a role in detecting early recurrence or early metastatic disease

PET/CT

- Difficult to monitor for suspected recurrence as other imaging techniques lacked sensitivity and precision, frequently resulting in diagnostic and therapeutic delays

PET/CT



- ? Tumor recurrence
- ? Postoperative change
- ? Postradiation change

NEGATIVE BIOPSY

PET/CT

- **Able to distinguish benign and malignant presacral abnormalities with a sensitivity, specificity, positive predictive value and negative predictive value of 100%, 96%, 88% and 100% respectively.**

Radiology 2004;232:815-822

PET/CT

- **Australian PET Data Collection Project**
- **Group A (residual lesion suggestive of recurrent tumor).**
- **Group B (pulmonary or hepatic metastases that were considered potentially resectable).**
- **191 patients**

Journal of Nuclear Medicine 2008; 49(9):1451-1457

PET/CT

- **GROUP A**
  - **Additional sites of disease detected in 48.4%**
  - **Change in management documented in 65.6%**
- **GROUP B**
  - **Additional sites of disease detected in 43.9%**
  - **Change in management documented in 49.0%**

Journal of Nuclear Medicine 2008; 49(9):1451-1457

PET/CT

- Not presently indicated for screening, diagnosis or in those with known disseminated disease
- Early detection of recurrent disease
  - Prior to curative partial hepatic resection
  - Elevated CEA when conventional workup does not indicate site of recurrence
  - High risk patient
  - Monitoring efficacy of treatment