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The 3rd Thailand MD Anderson Cancer Center Sister Institute Academic Conference 2019
"Current & Future Treatment of Colorectal Cancer"
November 15, 2019 Movenpick BDMS Wellness Resort Bangkok

Imaging in Rectal Cancer "Endoscopic ultrasound"

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DISCLOSURES

No disclosures relevant to this topic

Imaging in Rectal Cancer
“Endoscopic ultrasound”

1. Imaging: ERUS (TVUS)
2. Rationale
3. Good enough?

Imaging in Rectal Cancer
“Endoscopic ultrasound”

1 Imaging: ERUS

2 Rationale

3 Good enough?

- Anorectal anatomy
- Equipment
- Technique
- Imaging: rectal Ca. staging (uTN)

Anatomy of Rectum

Ra

Peritoneal reflection

Rb

15-17 cm

11-13 cm

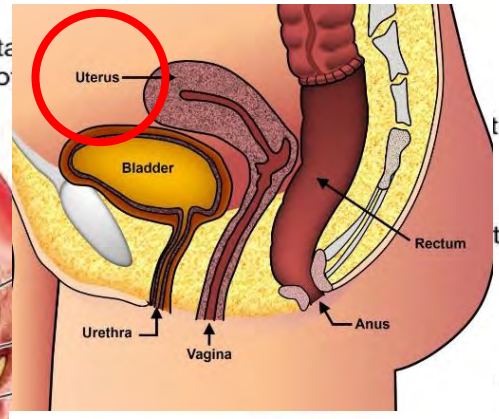
8-9cm

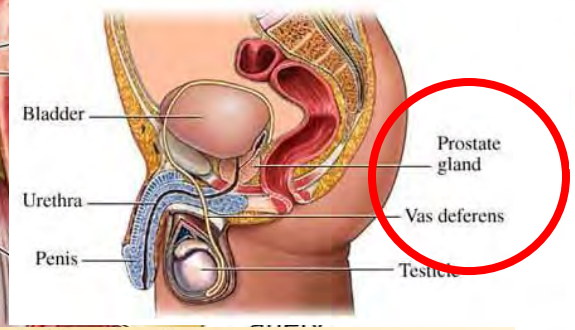
5-6 cm

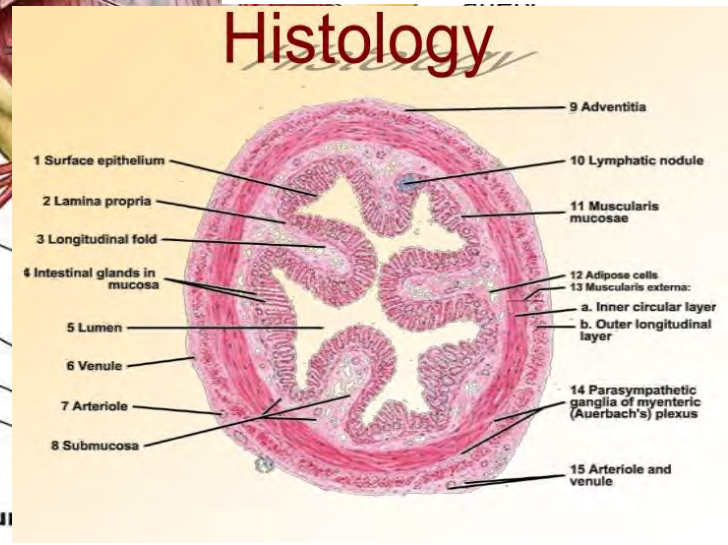
4 cm

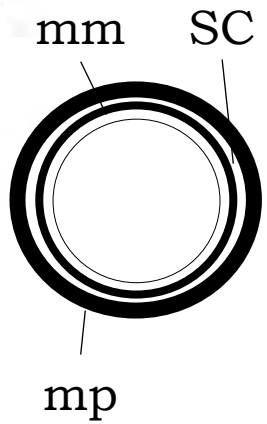
0.5-1 cm

Inguinal LN
External iliac LN









Miniprobe

:Combined with regular colonoscope
: High frequency (20MHz)
: Good for T stage

Radial scope

: 360^0 scope based EUS
: Frequency (5-12MHz)

Linear scope

: 140^0 – 180^0 scope based EUS
: FNA capability

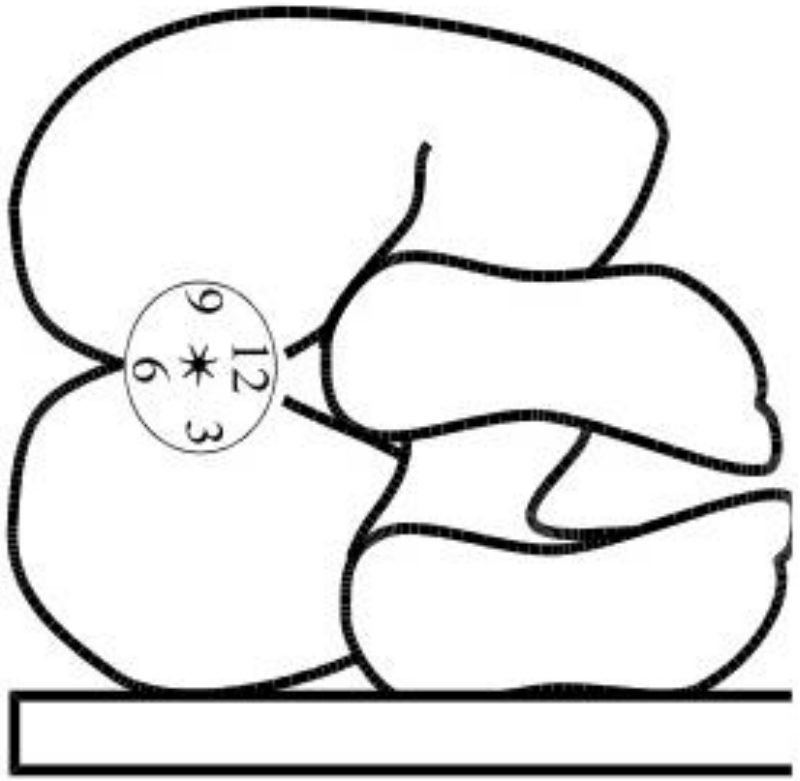
Rigid probe

Use after colonoscope
Good for lower rectum

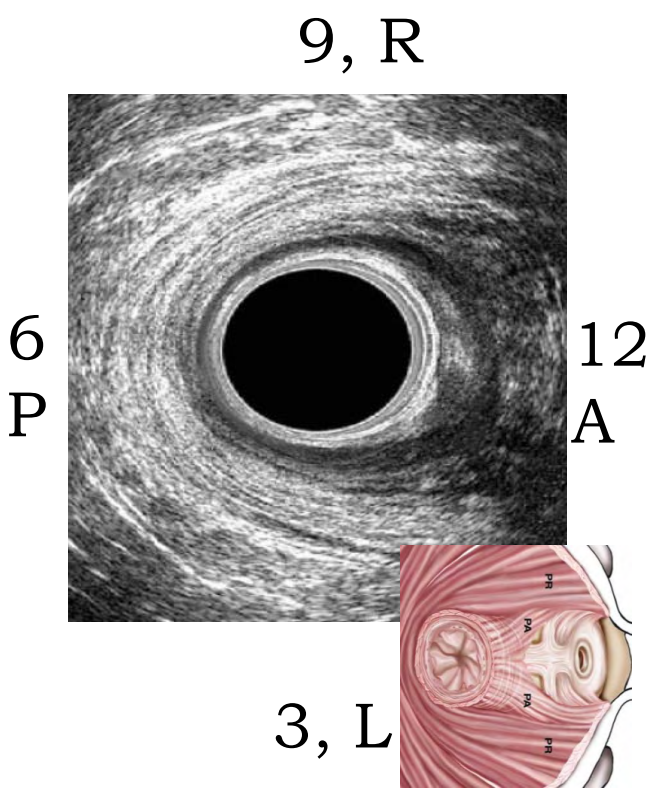
Rectal EUS (ERUS)

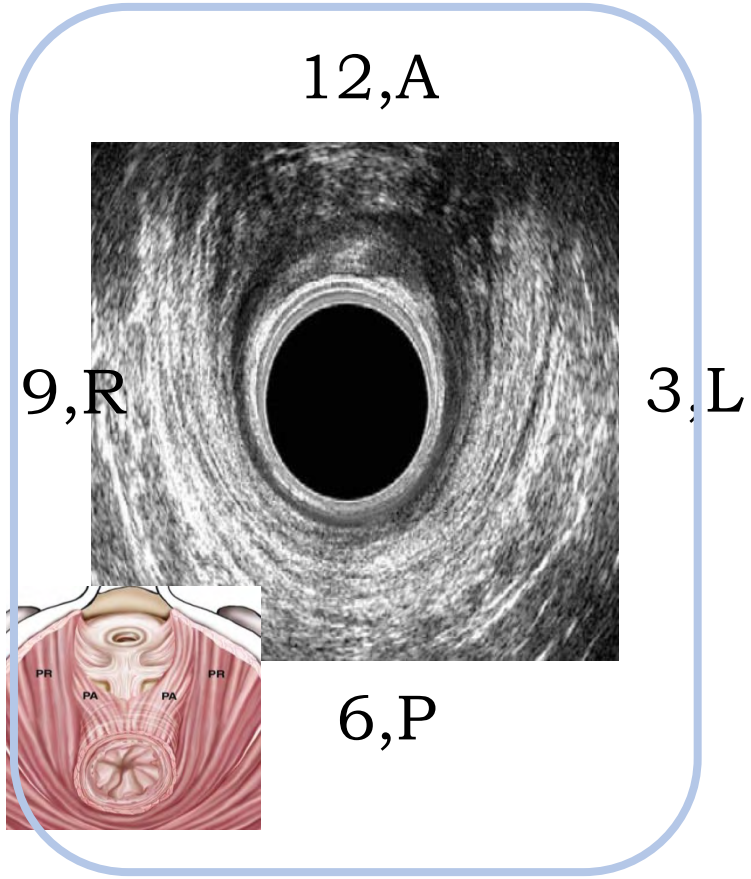
- **Out-patient procedure**
- **Enema in advance/ full bowel prep. (optional)**
- **IV sedation: optional, MAC**
- Left lateral position
- **Digital rectal examination**
  sphincter tone
  mass-location (R,L,A,P) related with normal structure
  distant from anal verge, fix or mobile
- **Probe selection**
  rigid (+endoscopy) or flexible scope or miniprobe
- **Frequency**
  rectal wall 10-12 MHz, surrounding area 5-7.5MHz.
  lower 10-12 (7.5) MHz, upper 5-7.5 MHz
  20 MHz for miniprobe
- **Target lesion-Water filled technique with fully distension**
  (change position to keep water filled lesion)
- **Orientation of anatomy with probe**
  genito-uninary structures, patient position
- **Start at 25-30 cm from anal verge (except rigid probe)**
  vascular structure, adenopathy
  lesion-deep invasion
- **Magnified tumor site to see more in detail**.

EUS Imaging: Image orientation



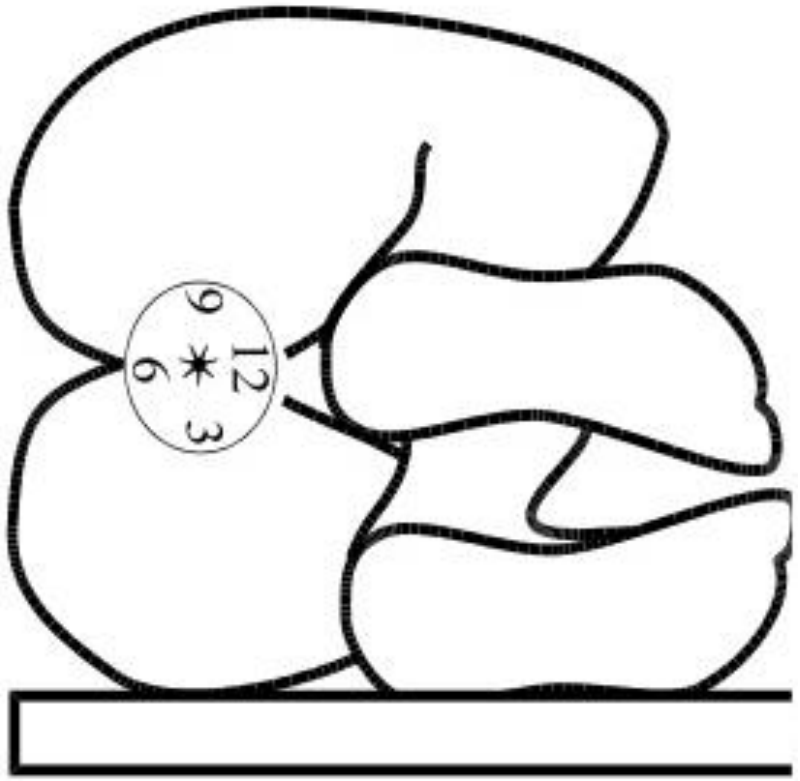
Picture from Clinical Resource Cente, University of Liverpool,UK

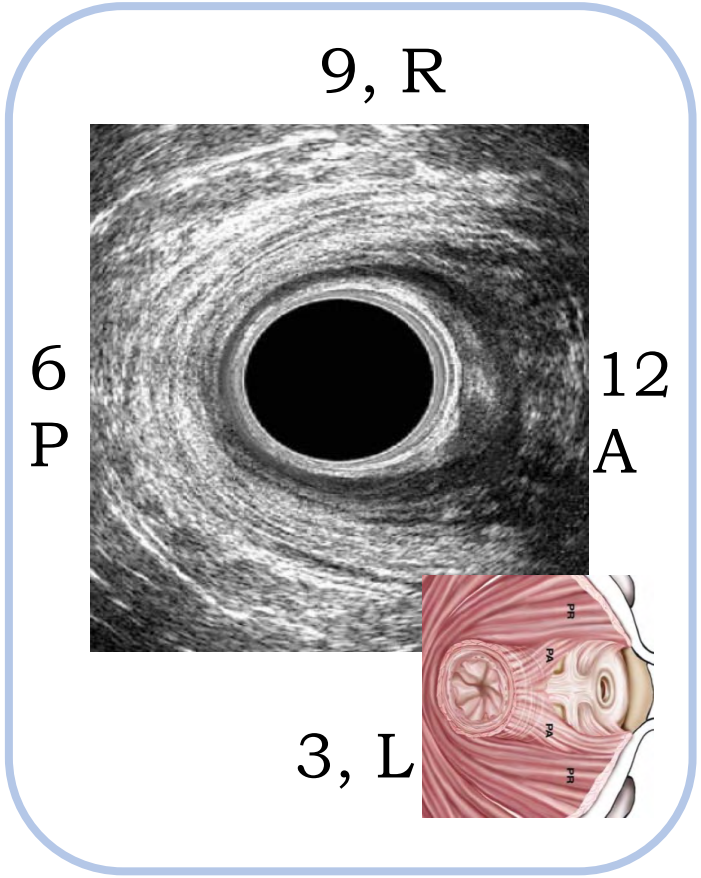


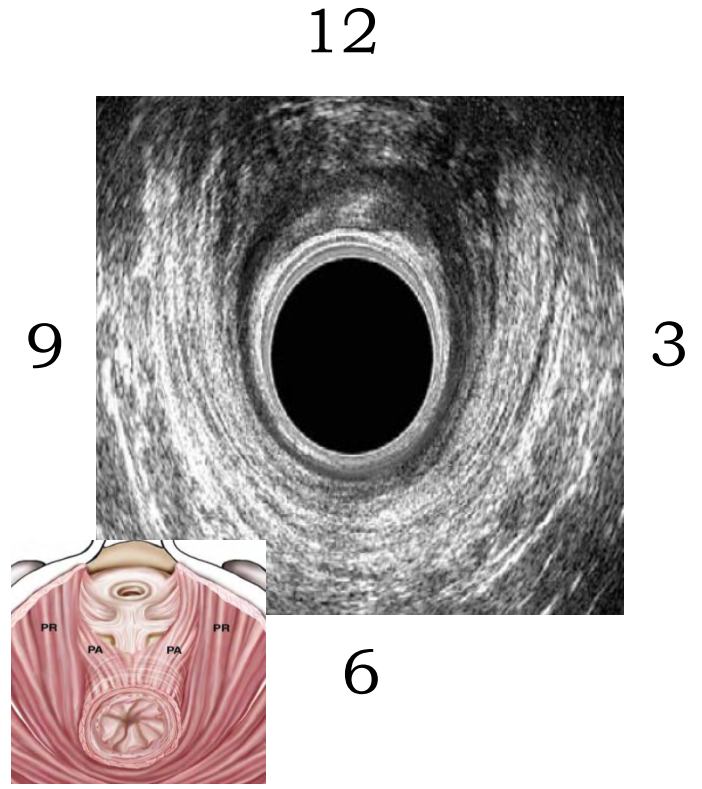


Courtesy: Santoro GA, Di Falco G. Benign Anorectal Diseases.2006 for all images

EUS Imaging: Image orientation



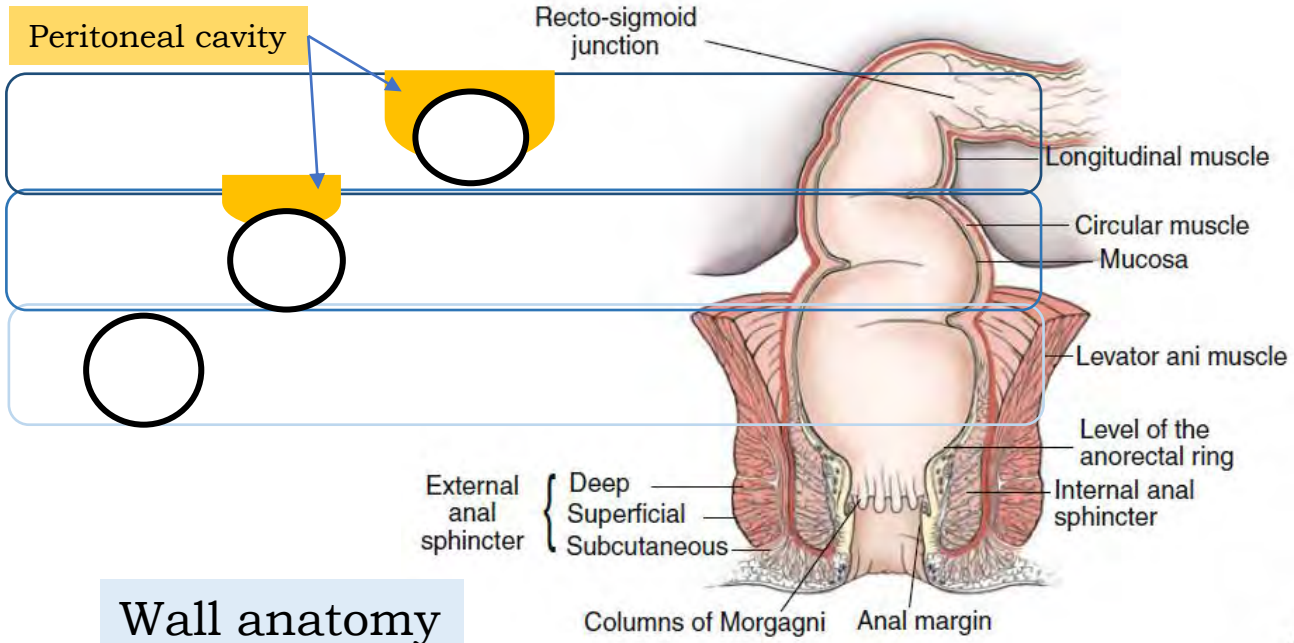


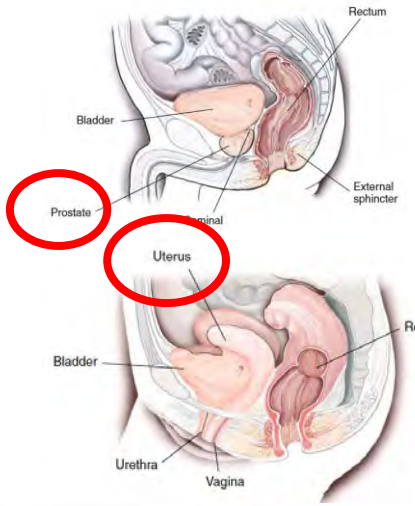


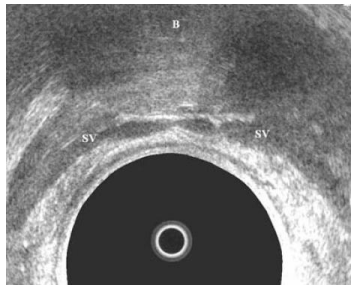
Picture from Clinical Resource Cente, University of Liverpool,UK

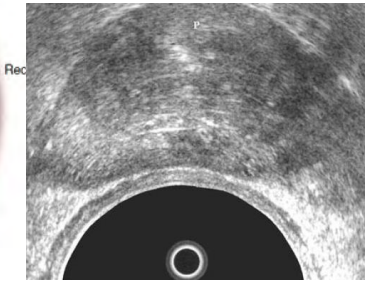
Courtesy: Santoro GA, Di Falco G. Benign Anorectal Diseases.2006 for all images

Rectal EUS: Imaging Anatomy



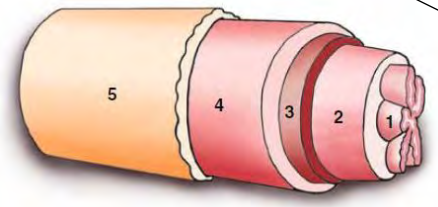


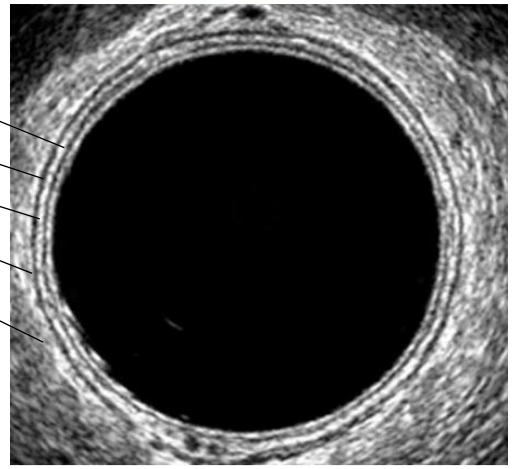


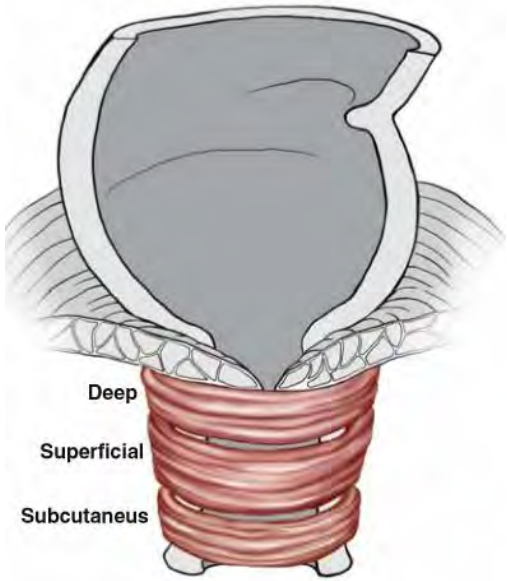


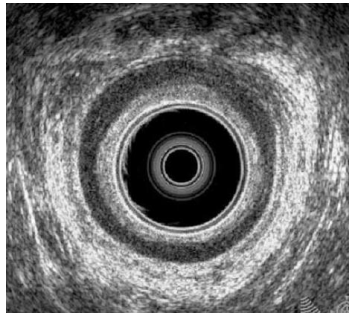
Wall anatomy

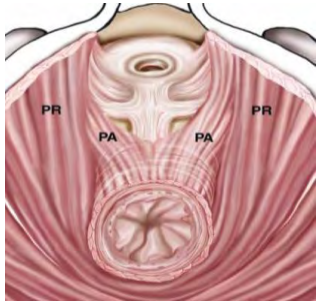
Mucosa (white)
MM (black)
SM (white)
MP (black)
Serosa/perirectal (white)

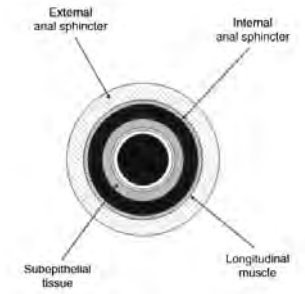






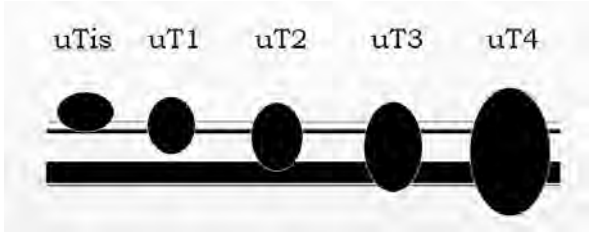


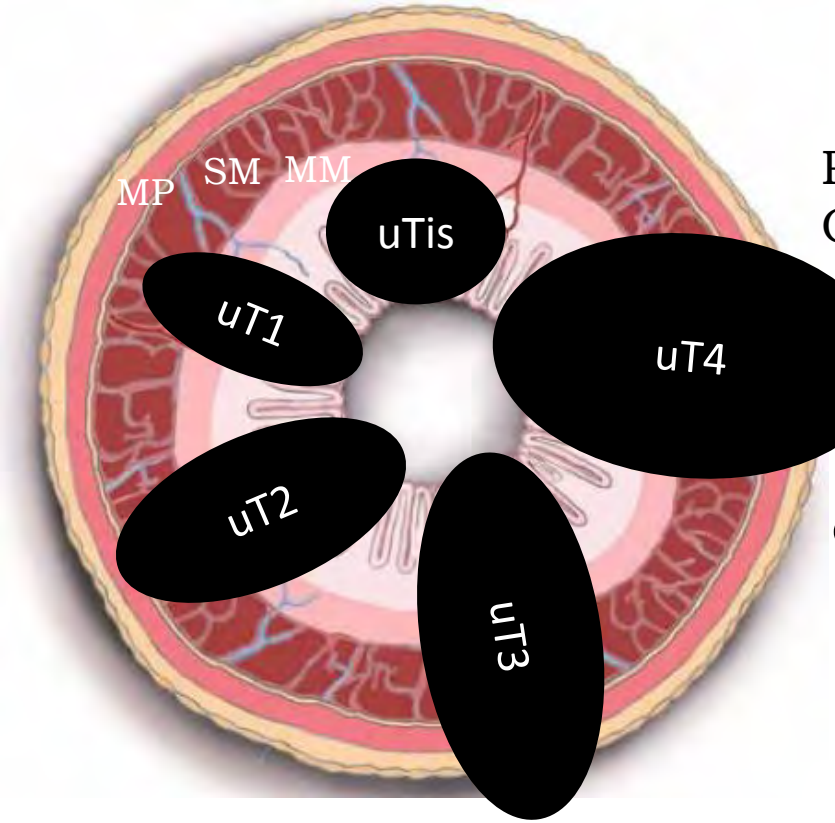




Courtesy: Santoro GA, Di Falco G. Benign Anorectal Diseases.2006 for all images

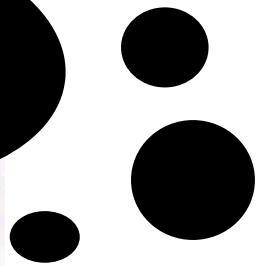
EUS: Rectal cancer staging





Perirectal

Peritoneum: T4a
Organ;T4b



uN0: no enlargement of lymph node
uN1: enlarged perirectal lymph node

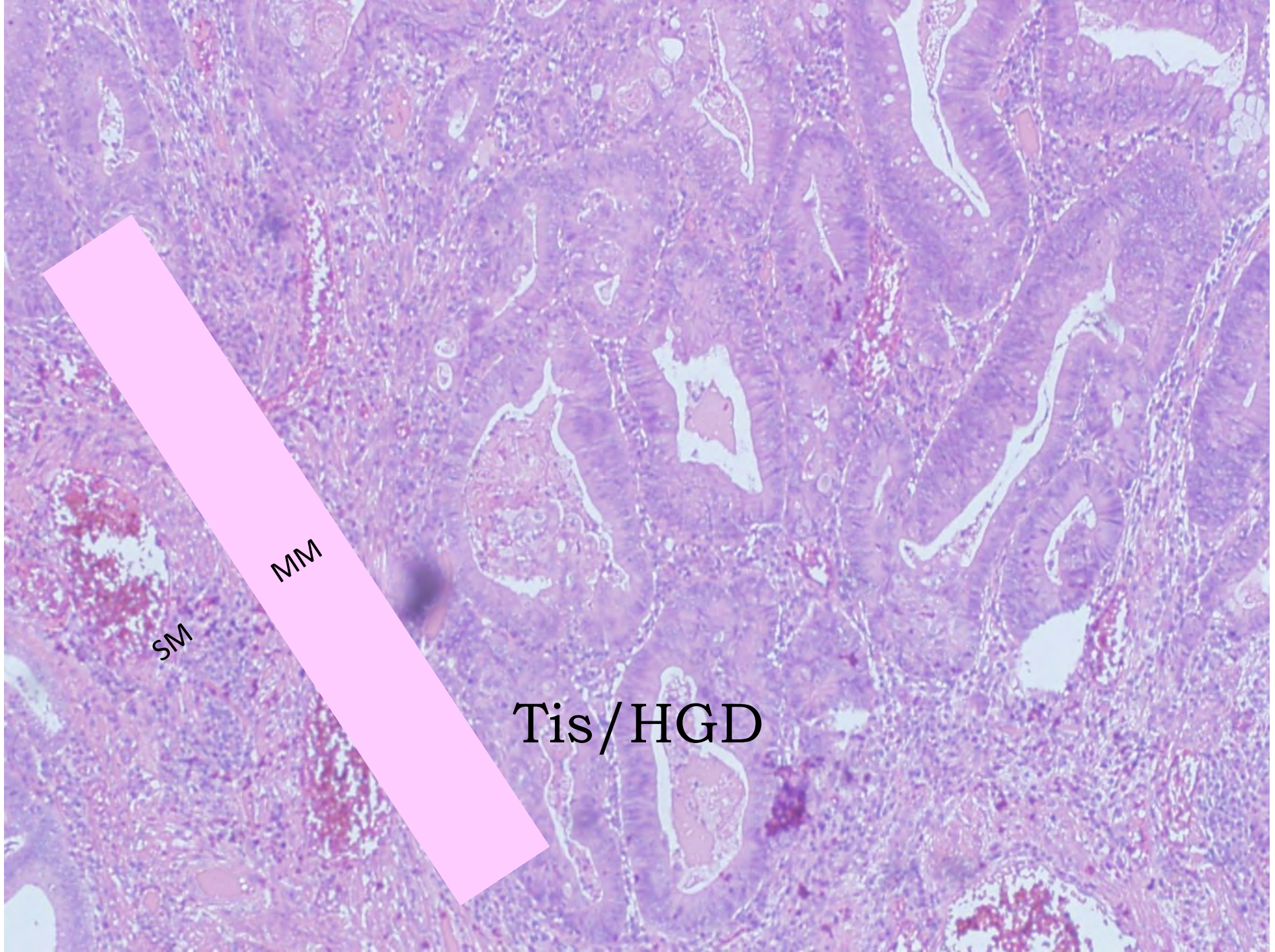
Picture-Courtesy: Santoro GA, Di Falco G. Benign Anorectal Diseases.2006


06/02/2018
08:17:53
1/60
Lv-1 AUTO
S1:FRZ
S2:FICE
S3:IRIS
2.8
11.4
11.5
EG-580UR
1U048K057
HI NR
SE
BL-7000
1

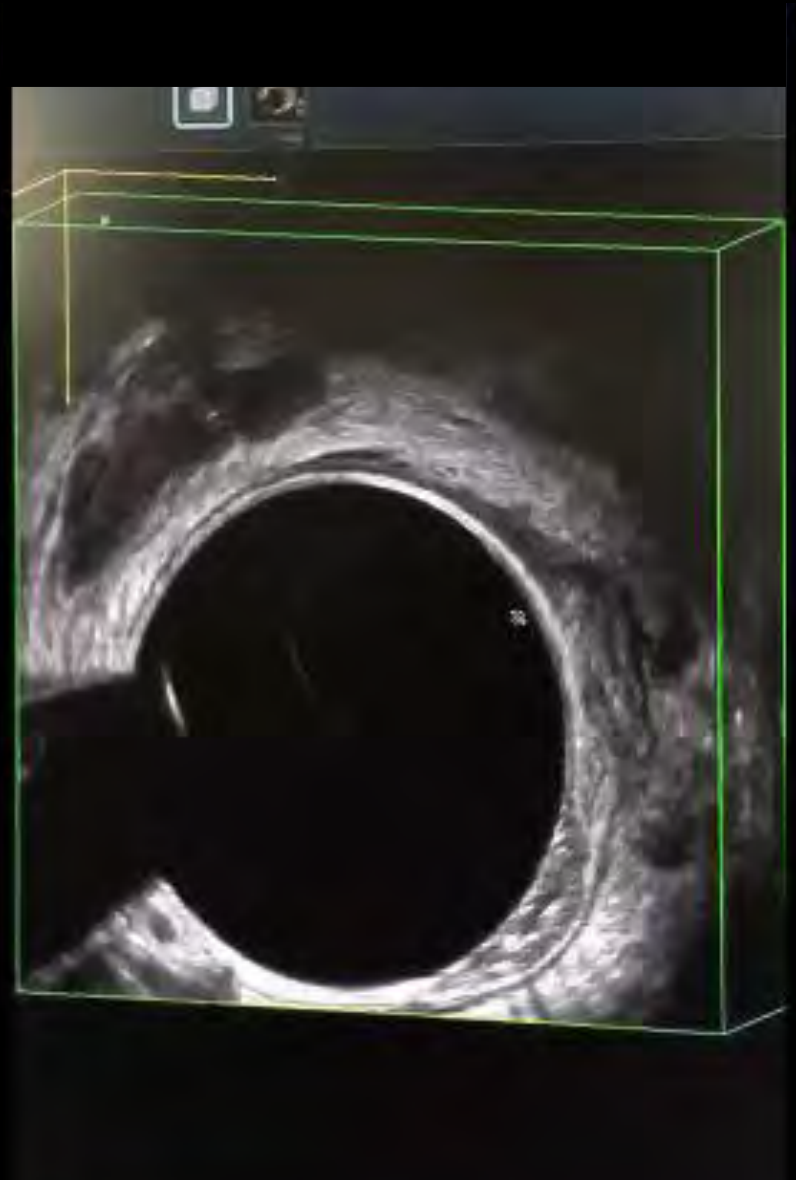

25/01/2018
11:29:45
NOOOOF
+1/100
Lv+1 PEAK
S1 FRZ
S2 LM
S3 OM DW
3.2
11.7
11.8
EC-760ZP-V/L
1C731K148
HT NR
SE:ア
BL-7000
0


EUS-1/General
RAJVITHI HOSP
30/01/2018
12:56:14
EG-580UR
MI:0.5
TIs:0.1
AP:100%
D:50mm
50
0
50
F
FR:18.0Hz
B
FB:7.5M
G:46
DR:55
1540m/s
E:2 P:2 M:G7
SR:2 S:2
F1:TH
F2:CH
F3:CHI
F4:End Exam
91%


RAJVITHI HOSP
30/01/2018
12:56:23
EUS-1/General
EG-580UR
MI:0.5
TIs:0.1
AP:100%
D:50mm
50
0
50
F
FR:18.0Hz
B
FB:7.5M
G:46
DR:55
1540m/s
E:2 P:2 M:G7
SR:2 S:2
F1:TH
F2:CH
F3:CHI
F4:End Exam
0
91%


SM
MM
Tis/HGD

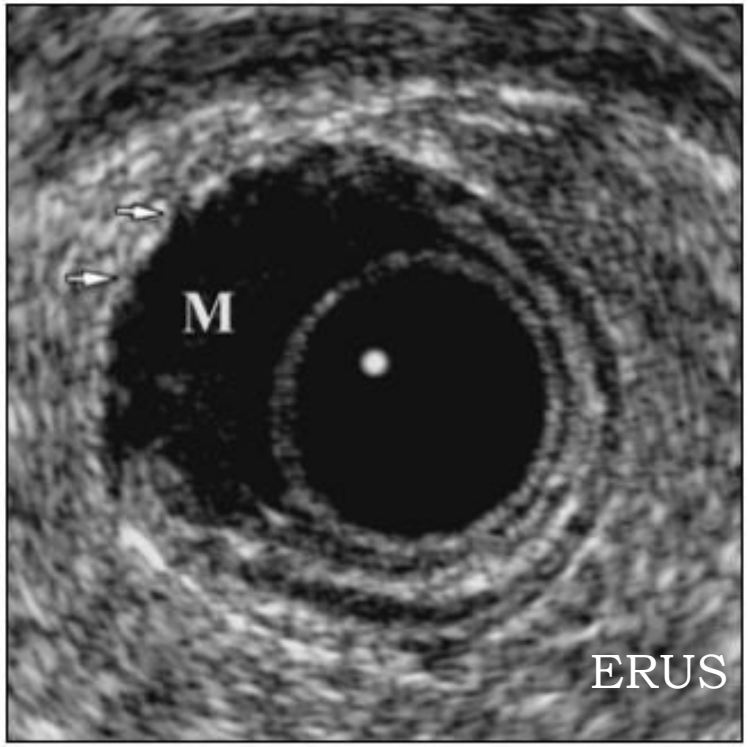
3-D RUS

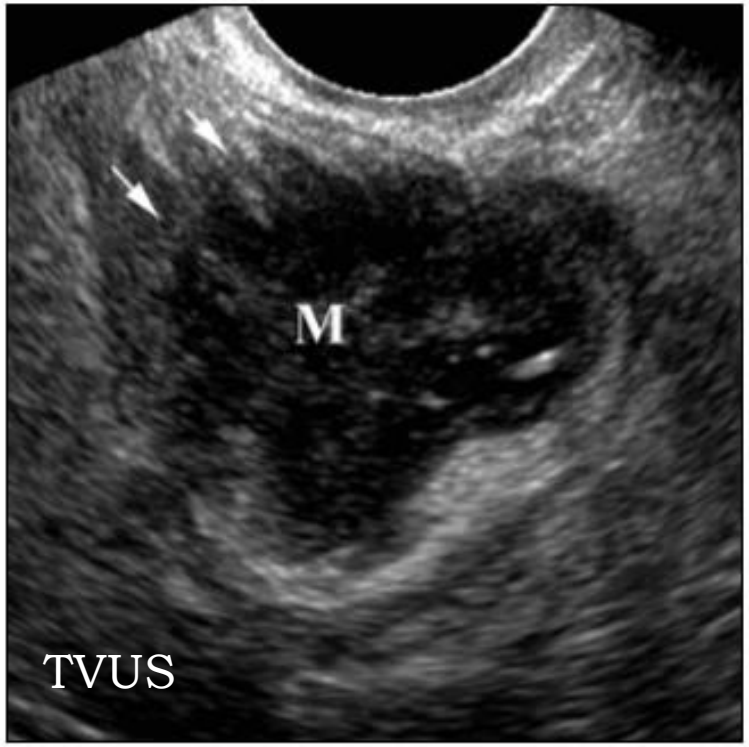


Rectal cancer: Imaging from TVUS

Transvaginal Sonography as an Adjunct to Endorectal Sonography in the Staging of Rectal Cancer in Women

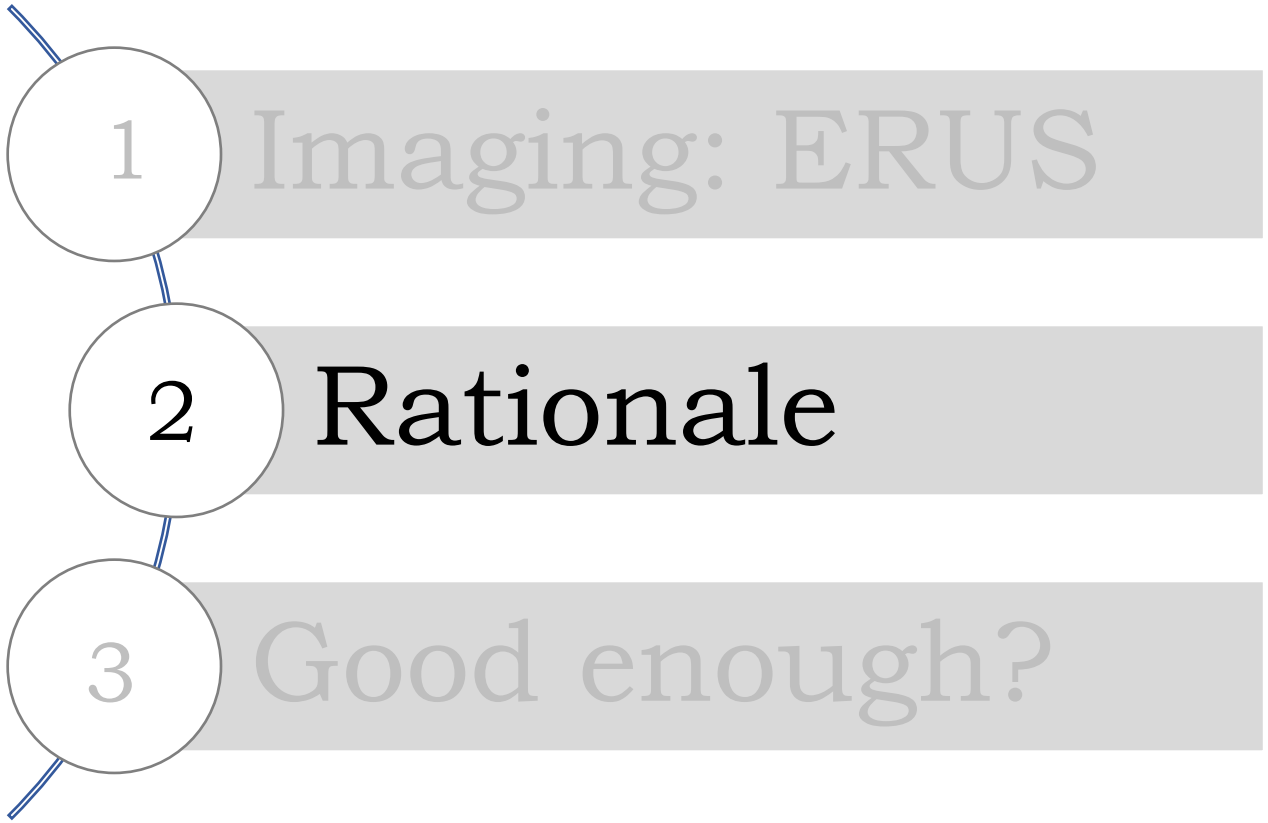
Esp. Anterior lesion & Obstructive lesion





Dhamanaskar KP, Thurston W, Wilson SR. AJR 2006; 187:90–98

Imaging in Rectal Cancer
Endoscopic ultrasound



NCCN Guidelines Version 2.2016
Rectal Cancer

NCCN Guidelines Index
Rectal Cancer Table of Contents
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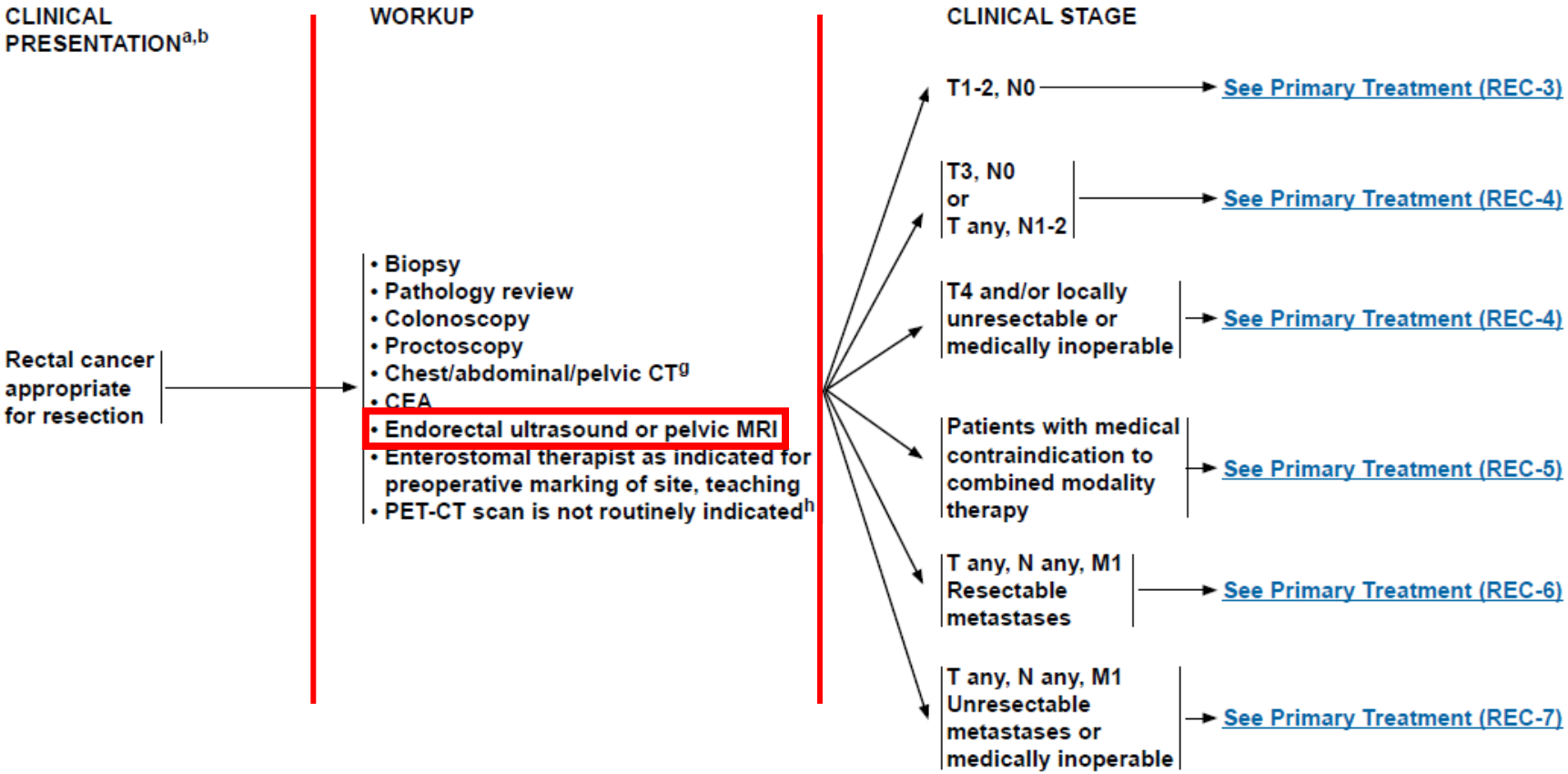
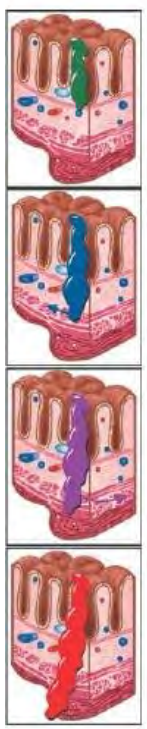


[a]All patients with rectal cancer should be counseled for family history. Patients with suspected hereditary non-polyposis colorectal cancer (HNPCC), familial adenomatous polyposis (FAP), and attenuated FAP, see the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Colorectal.
[b]For melanoma histology, see the NCCN Guidelines for Melanoma.
[g]CT should be with IV and oral contrast. Consider abdominal/pelvic MRI with MRI contrast plus a non-contrast chest CT if either CT of abd/pelvis is inadequate or if patient has a contraindication to CT with IV contrast.
[h]PET-CT does not supplant a contrast-enhanced diagnostic CT scan. PET-CT should only be used to evaluate an equivocal finding on a contrast-enhanced CT scan or in patients with strong contraindications to IV contrast.

Note: All recommendations are category 2A unless otherwise indicated.
Clinical Trials: NCCN believes that the best management of any cancer patient is in a clinical trial. Participation in clinical trials is especially encouraged.

Guideline management of rectal cancer



T1
SM

T2
MP

T3
perirectal

T4
Peritoneum
Adjacent organ

0: Tis — Endoscopic/local excision
Superficial SC, <1000 um

I: T1-T2,N0,M0 — Local excision/APR

IIA: T3,N0,M0
IIB: T4a,N0,M0
IIC: T4b,N0,M0

IIIA: T1-T2,N1/N1c,M0
T1,N2a,M0
IIIB: T3-T4a,N1/N1c,M0
T2-T3, N2a,M0
T1-T2,N2b,M0
IIIC: T4a,N2a,M0
T3-T4a,N2b,M0
T4b,N1-N2,M0

Consider Neoadjuvant
T3/T4
N1-N2
Medical unfit

IVA: Any T,Any N,M1a
IVB: Any T,Any N,M1b
IVC*: Any T,Any N,M1c

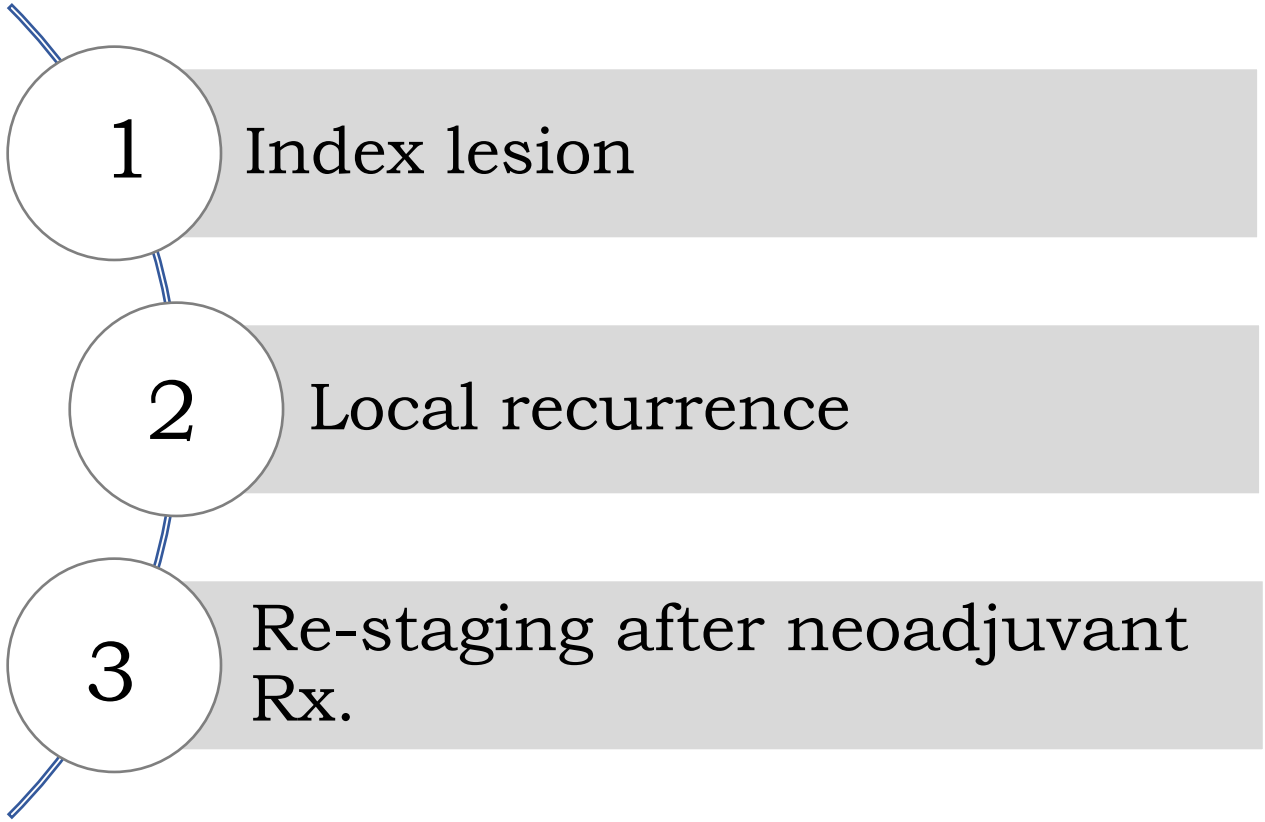
NCCN 2016/AJCC 2017*

NCCN 2016

ASCRS
American Society of Colon and Rectal Surgeons

Imaging in Rectal Cancer
Endoscopic ultrasound

Rectal Cancer Staging
EUS: Good enough?



EUS for rectal cancer staging

A Prospective, Blinded Assessment of the Impact of Preoperative Staging on the Management of RC in 80 patients.

	Sensitivity	Specificity	PPV	NPV	Accuracy
Teus (%)	85(68-95)	100(83-100)	100(88-100)	80(59-93)	91(79-97)
Neus (%)	74(52-90)	89(72-98)	85(62-97)	81(63-93)	82(69-92)
Nfna (%)	52(31-73)	96(82-100)	92(64-100)	71(54-85)	76(63-87)

" be careful tumor contamination from primary tumor"

(with 95% CI)

Harewood GC, Wiersema MJ, Nelson H, et al. Gastroenterol 2002;123:24-32

EUS for rectal cancer staging

Pooled studies of **T staging** rectal cancer by EUS

Meta-analysis and systemic review: 42 studies, 5,039 patients

	Sensitivity	Specificity	LR+	LR-	DOR
T1* (%)	88(85.3-90)	98(97.8-98.7)	44(22.7-85.5)	0.2(0.13-0.23)	334(161.4-690.4)
T2#(%)	81(77.9-82.9)	96(94.9-96.3)	7(11.9-24.9)	0.2(0.17-0.29)	92(64.2-132.2)
T3$(%)	96(95.4-97.2)	91(89.5-91.7)	9(6.8-11.8)	0.1(0.04-0.09)	205(124.9-336.6)
T4&(%)	95(92.4-97.5)	98(97.8-98.7)	38(19.9-71.0)	0.1(0.09-0.23)	368(170.9-790.6)

(with 95% CI)

LR+ positive likelihood, LR- negative likelihood, DOR diagnostic odds ratio
*39 studies
#41 studies
$ 41 studies
& 32 studies

Puli SR, Bechtod ML, Reddy JB, et al. Ann Surg Oncol 2009;16:254-265

EUS for rectal cancer staging

Pooled studies of **T0 staging (endoscopic resection)** rectal cancer by EUS

Meta-analysis and systemic review: 11 studies, 1,791 patients

	Sensitivity	Specificity	LR+	LR-	DOR
Year 1994-1999 (6 studies)					
T0(%)	96(91.6-98.8)	95(92.4-97.3)	16(9.4-28.3)	0.1(0.03-0.21)	279(84.0-926.9)
Year 2000-2006 (5 studies)					
T0(%)	100(92.6-100)	97(95.5-97.5)	26(18.9-35.6)	0.1(0.02-0.23)	540(131.3-2,223.7)

LR+ positive likelihood, LR- negative likelihood, DOR diagnostic odds ratio

(with 95% CI)

Puli SR, Bechtod ML, Reddy JB, et al. Dig Dis Sci 2010;55:1221-9

EUS for rectal cancer staging

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Teus (%)	85(68-95)	100(83-100)	100(88-100)	80(59-93)	91(79-97)
Neus (%)	74(52-90)	89(72-98)	85(62-97)	81(63-93)	82(69-92)
Tct (%)	61(42-77)	95(75-100)	95(76-100)	59(41-76)	74(60-85)
Nct (%)	52(31-73)	96(82-100)	92(64-100)	71(54-85)	76(63-87)

(with 95% CI)

Harewood GC, Wiersema MJ, Nelson H, et al. Gastroenterol 2002;123:24-32

EUS/MRI for rectal cancer staging

Prospective comparative study, 91 patients

MRI was not able to visualize any T1

The accuracy of EUS T staging = MRI
T2 76%(95% CI, 65%-84%) vs 77%(95% CI, 67%-85%);ns
T3 76%(95% CI, 65%-84%) vs 83%(95% CI, 73%-90%);ns

The accuracy of MRI for N staging -EUS,
79%(95% CI, 65%-88%) and 65%(95% CI, 51%-78%), ns

EUS & MRI: complementary information
EUS: T1,
MRI: M stage, stenotic tumor, less operator dependent

Fernández-Esparrach G, Ayuso-Colella JR, Sendino O, et al. GIE 2011;74:347-354
Bipat S, Glas AS, Slors FJ, et al. Radiology 2004;232:773-783
Arya S, Das D, Engineer R, Saklani A. Indian J Radiol Imaging. 2015 ;25:148-61.

EUS vs MRI for rectal cancer staging

A diagnostic test accuracy Meta-analysis

6/2475 studies: 234 pqtients

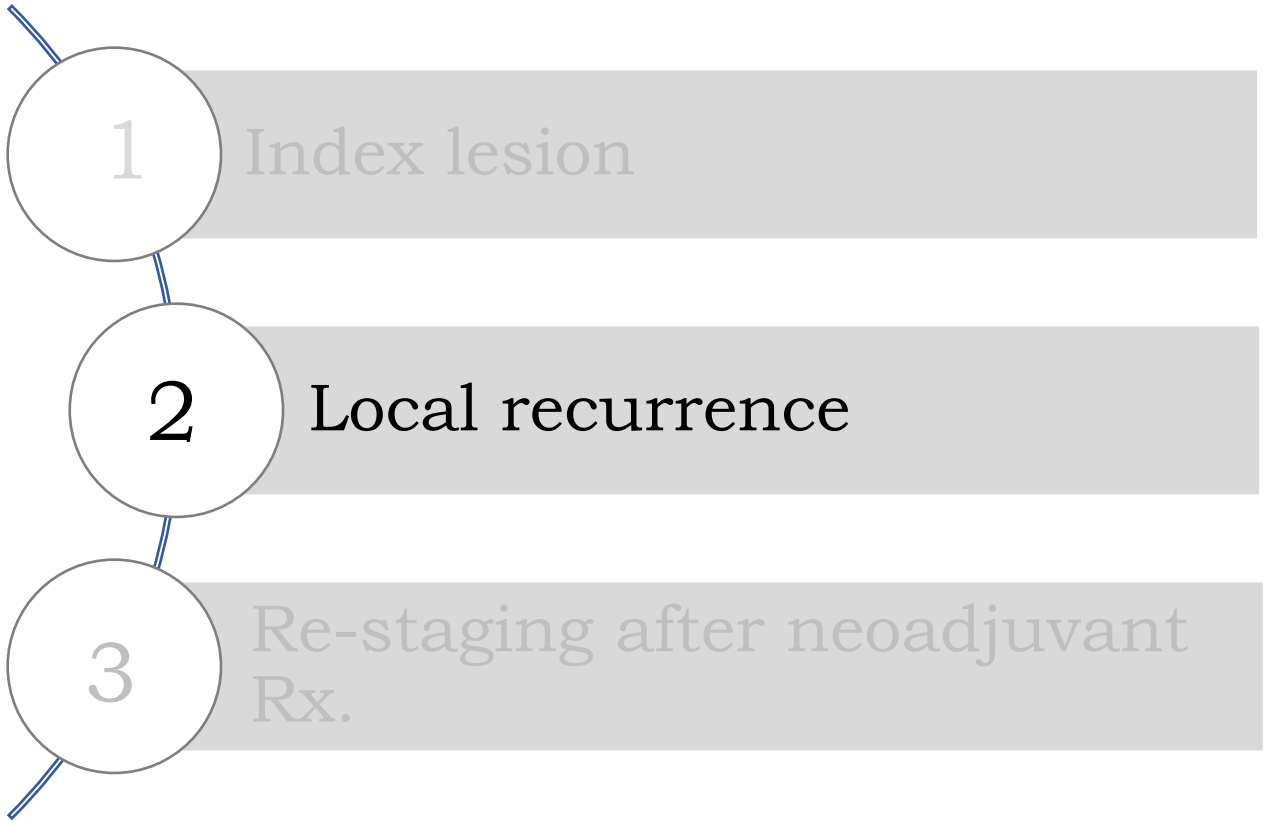
The overall T staging (AUC) EUS>MRI (.88 vs .82,p<0.5)
EUS: Sen .79 (95% CI .72-.85),Spec .89 (95% CI .84-.93)
MRI: Sen .79 (95% CI .72-.85), Spec .85 (95% CI .79-.90)

The overall N staging (AUC) EUS>MRI (.92 vs .85, p<0.01)
EUS: Sen .81 (95% CI .71-.89), Spec.88 (95% CI .80-.94)
MRI: Sen .83 (95% CI .73-.90), Spec.90 (95% CI .82-.95)

EUS & MRI: complementary information
EUS: T1,T3 BUT MRI is better in T2 (p=0.01)
MRI: M stage, stenotic tumor, less operator dependent

Brian PH, Patel R, Mbuagbaw L, et al. GIE 2019;90:196-203.

Rectal Cancer Staging
EUS: Good enough?



EUS for local rectal cancer recurrences

Ix: serial CEA levels, digital examination, Colonoscopy, CT/MRI

Add EUS

1997 Rotondano 62 patients: 192 exam. (2-7 each patient) LR 11 patient (2 only by EUS)

2000 Stefan 338 patients: 721 exam. (1-10each, mean 2.1) LR 116 patient (all by EUS)

2001 Hunerbein 312 patients: 68 FNA. LR 36 (luminal 12) patient
(FNA+ perirectal Ca. 22, benign 41, fail 5)
Sensitivity 91% , Specificity 93%, Accuracy 92%

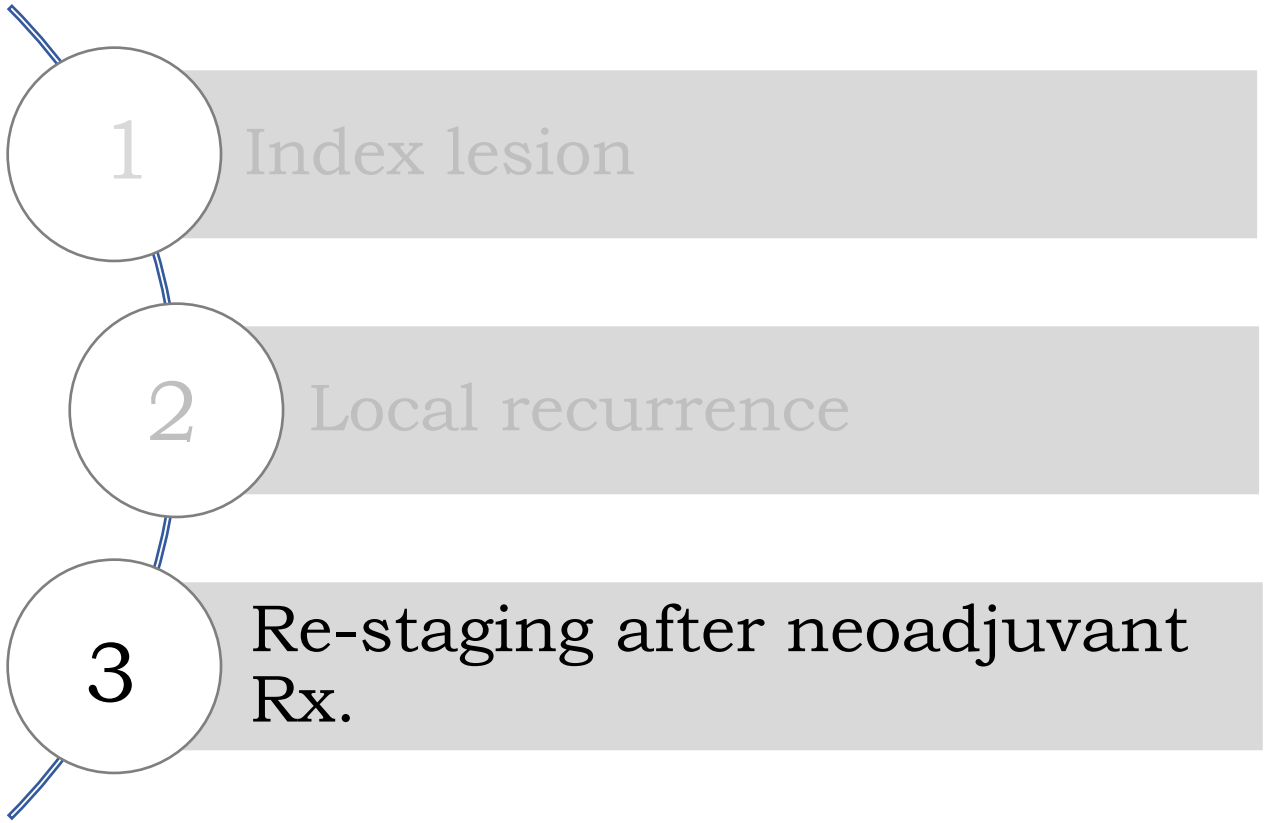
**Effectiveness of ERUS to detect occult LR,
So, EUS should be the part of work up regularly**

Rotondano G, P Esposito P, PellecchiaL, et al.BJR 1997;70: 567-571

Stefan M, Lohnert S .Dis Colon Rectum 2000;43:483-491

Hunerbein M, Totkas S,ta KT, Moes et al. Surgery 2001;129:164-9

Rectal Cancer Staging
EUS: Good enough?



EUS after Neoadjuvant

Forty-six studies comprising 2,224 patients, after neoadjuvant Rx.

Pooled accuracy	EUS	MRI	CT
Tumor response (complete)	82%	75%	83%
T4 tumor invasion	94%	88%	
Ln metastasis	72%	72%	65%

EUS was unable to accurately distinguish post-radiation changes from residual tumor.

Vanagunas A, Lin DE, Stryker SJ. J Gastroenterol2004;99:109-112

de Jong EA, ten Berge JC, Dwarkasing RS, et al. Surgery 2016;159:688-99

Imaging in Rectal Cancer
Endoscopic ultrasound

ERUS is valuable established procedure provide excellent Image to evaluate rectal cancer in term of loco-regional staging. It can guide to proper selected candidate for local resection or giving neoadjuvant to decrease local recurrence.

Also, It should be the part of investigation to follow up post surgery to detect occult local recurrence as well.

Lastly, some benefit to evaluate tumor response after CRT not only imaging but also getting tissue confirmation.

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The 3rd Thailand MD Anderson Cancer Center Sister Institute Academic Conference 2019
"Current & Future Treatment of Colorectal Cancer"
November 15, 2019 Movenpick BDMS Wellness Resort Bangkok

Thank you very much for kind your attention

EUS Image: 3-D vs 2-D

Forty-six studies comprising 2,224 patients, after neoadjuvant Rx.

Accuracy	2-D	3-D	CT
T stage	69%	78%	57% p<0.0010.002
N stage	56 %	65%	53% p<0.001-006
After eliminating examiner errors			
T stage	88%	91%	
N stage	76%	90%	

* Eliminated examiner error: 47% for 2-D, 65% for 3-D

Kim JC, Kim HC,Yu CS, et al. Am J Surg 2006;192:88-97