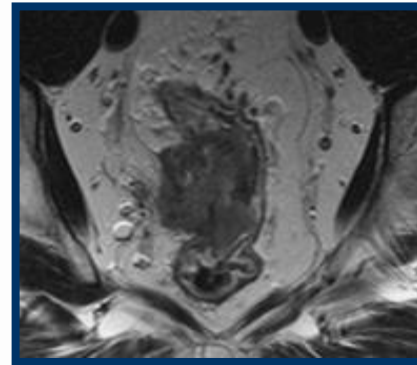


# 20<sup>TH</sup> ANNUAL CONFERENCE OF THE EGYPTIAN GROUP OF COLON AND RECTAL SURGEONS



## Pelvic MRI imaging for rectal cancer



GL Beets

**Department of Surgery  
Netherlands Cancer Institute  
Amsterdam, The Netherlands**



- No disclosures



**Regina Beets-Tan**

**Department of Radiology  
Netherlands Cancer Institute  
Amsterdam, The Netherlands**



- General MRI concepts
- Staging
- Surgery
- Assessment of response
- Future developments

# Imaging and surgeons



Know your enemy and know yourself and you  
can fight a hundred battles without disaster.

(Sun Tzu)

izquotes.com



# Imaging technology

CT- scan

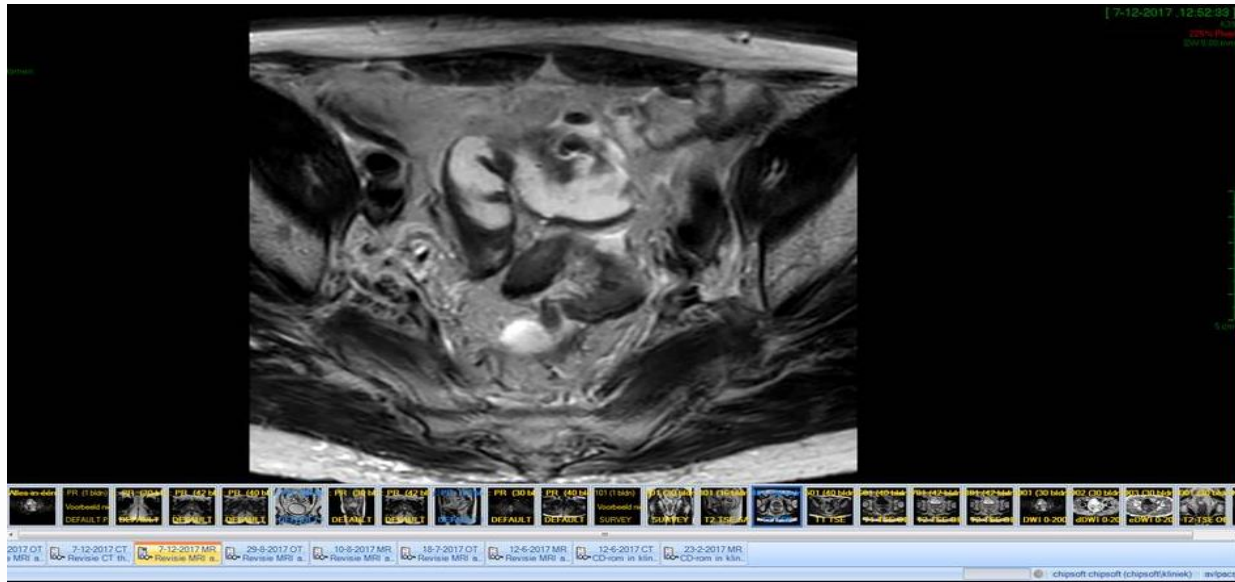


MRI-scan



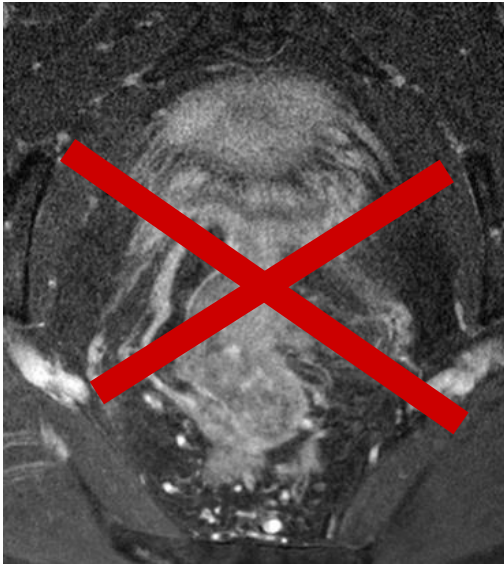
[www.alamy.com](http://www.alamy.com) - CXKJ4W

# MRI Sequences

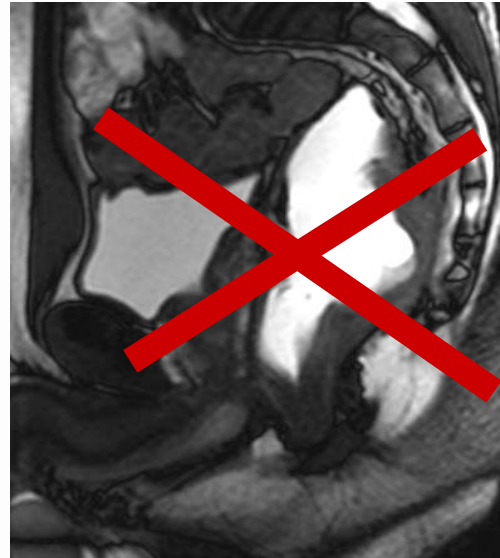


- Turbospin, fatsat, dynamic, flair, SWI, stir.....
- **T2w axial, sagittal, coronal**
- High definition
- Diffusion

# Not required



fat sat



rectal filling

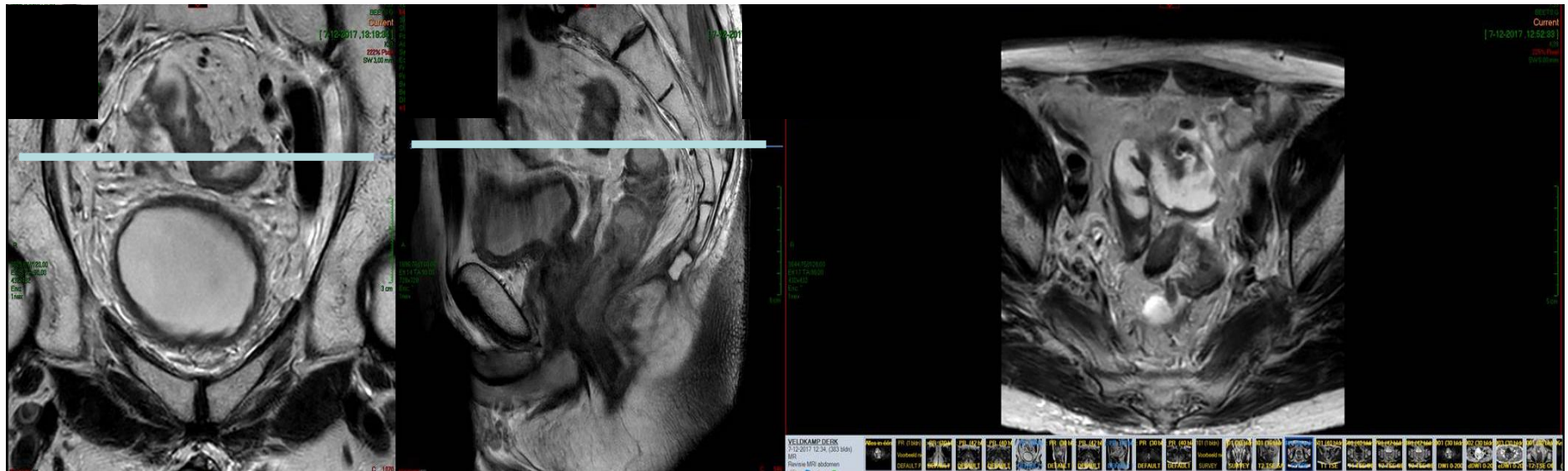
# Sagittal, Axial, Coronal

- Scout line

cor

sag

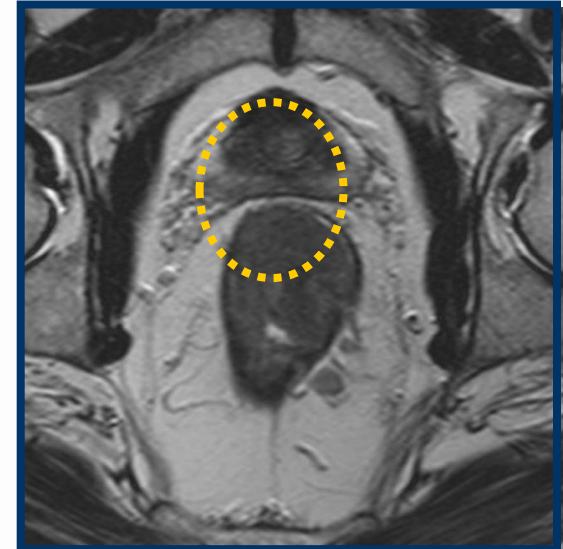
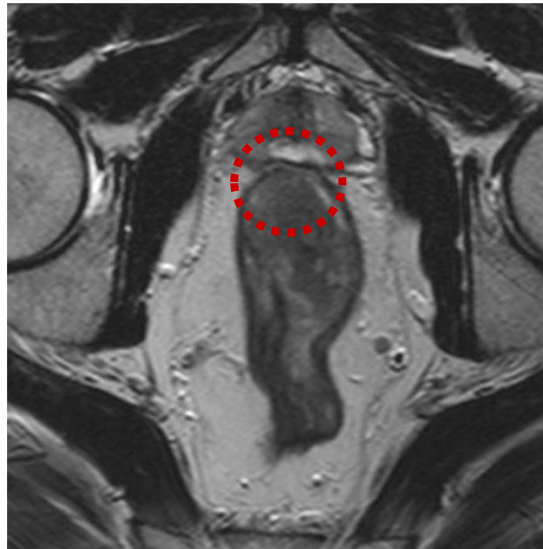
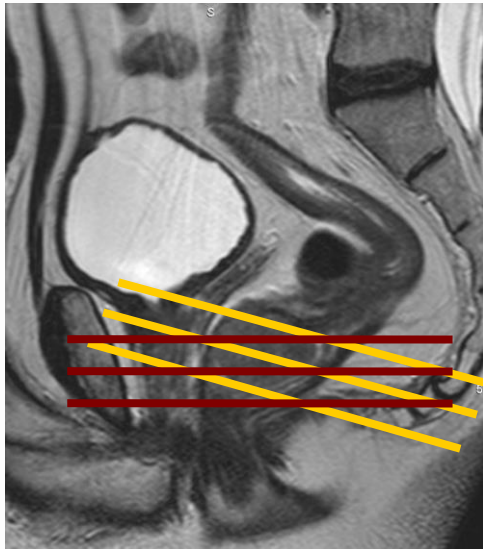
ax





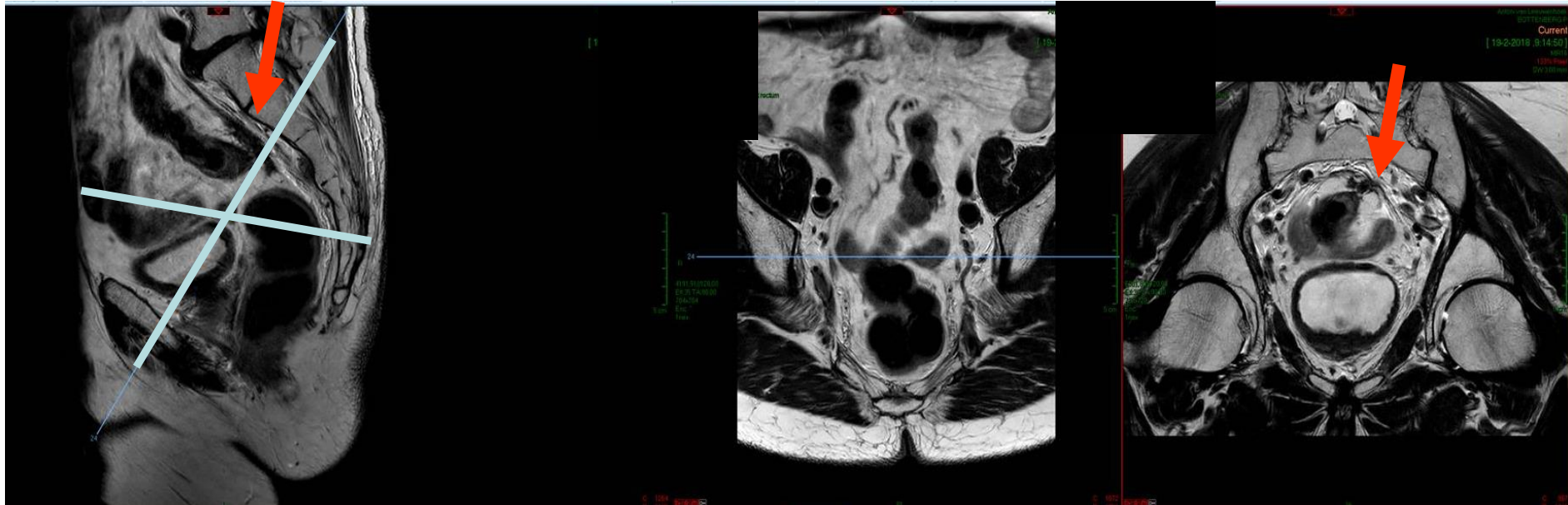
# Angulation of 'axial plane'

- Perpendicular to long axis bowel/tumor
- ! Follow up – serial imaging



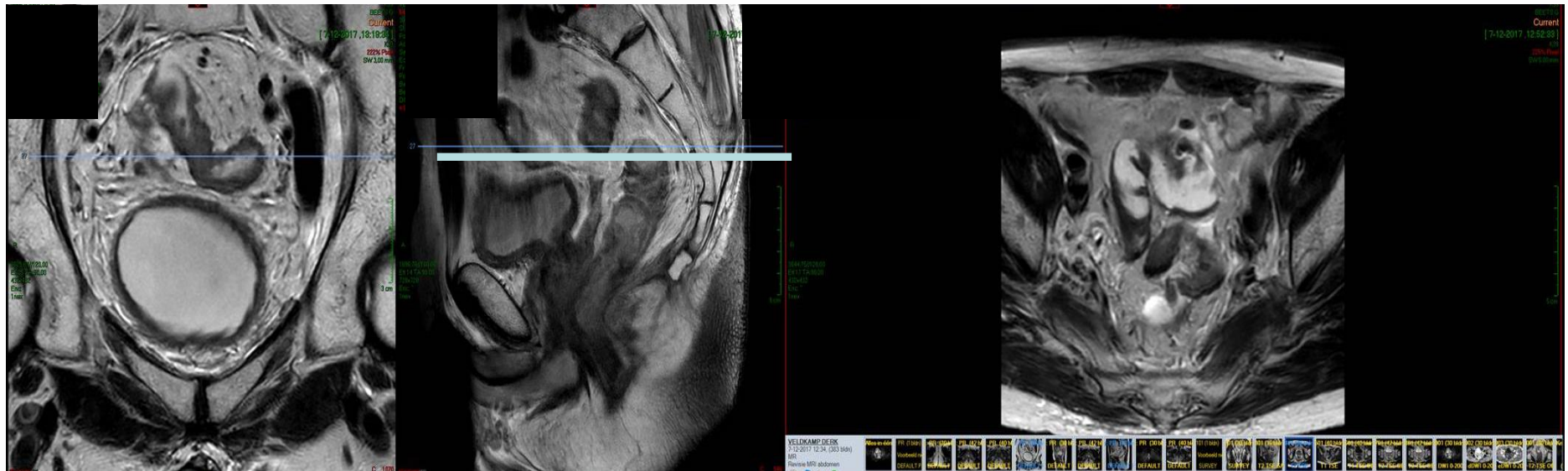
# Sagittal, Axial, Coronal

- Sagittal is always the same
- Axial and Coronal are variable



# Field of view

- Large enough FOV



# MRI terminology

- Hyper-intense
- Iso-intense
- Hypo-intense
- White
  - Water, mucine, fat, bone
- Gray
  - Tumor
- Black
  - Muscle, air, fibrosis

# Primary staging: risk factors for local recurrence

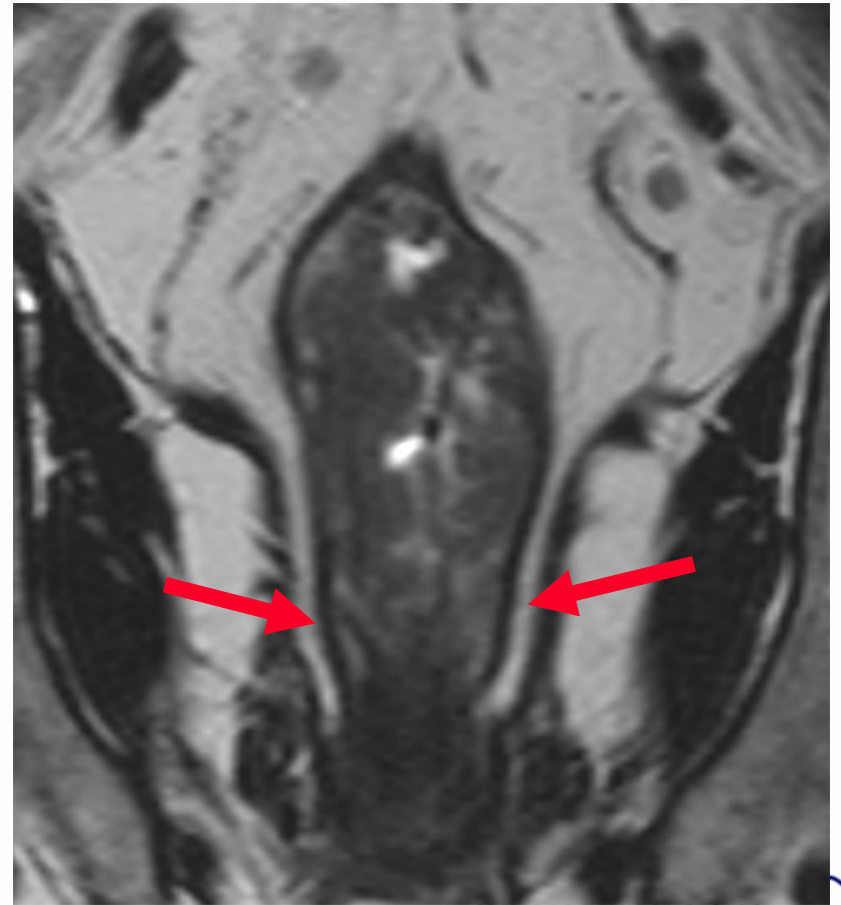
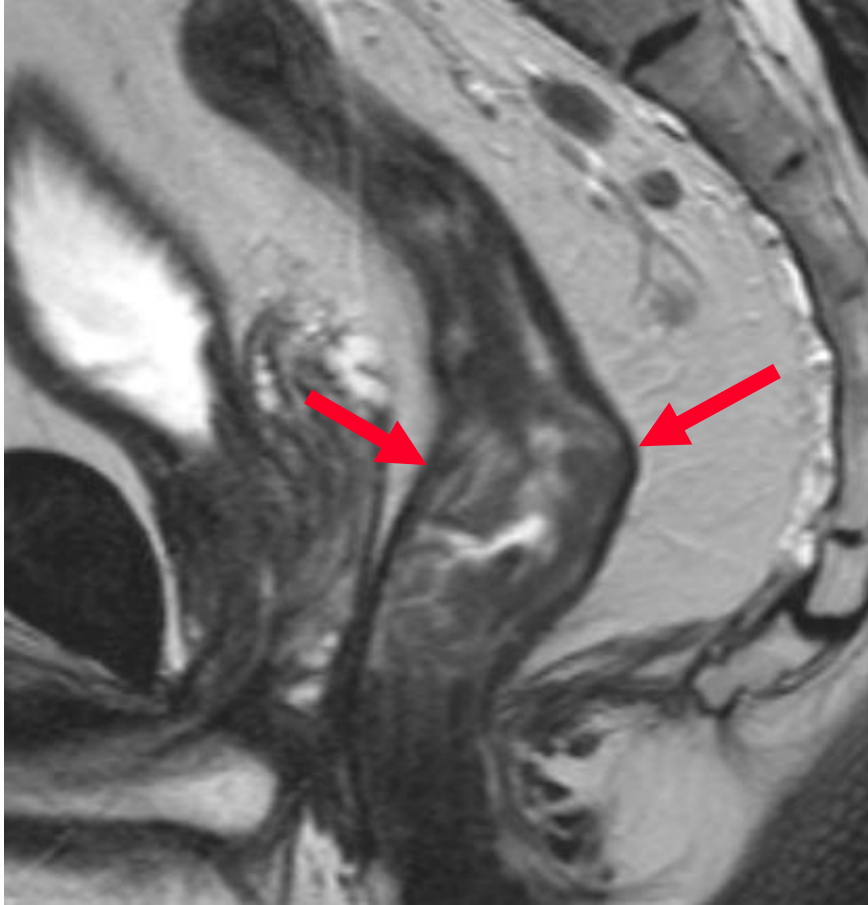
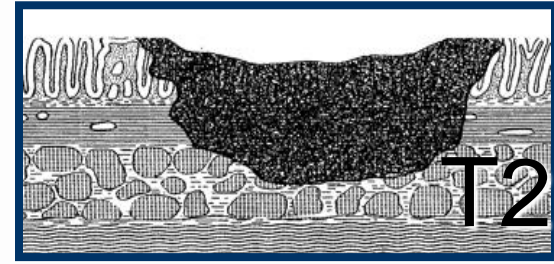
- Traditional
  - T stage
  - N stage
- Modern
  - T stage subdivisions
  - MRF
  - EMVI

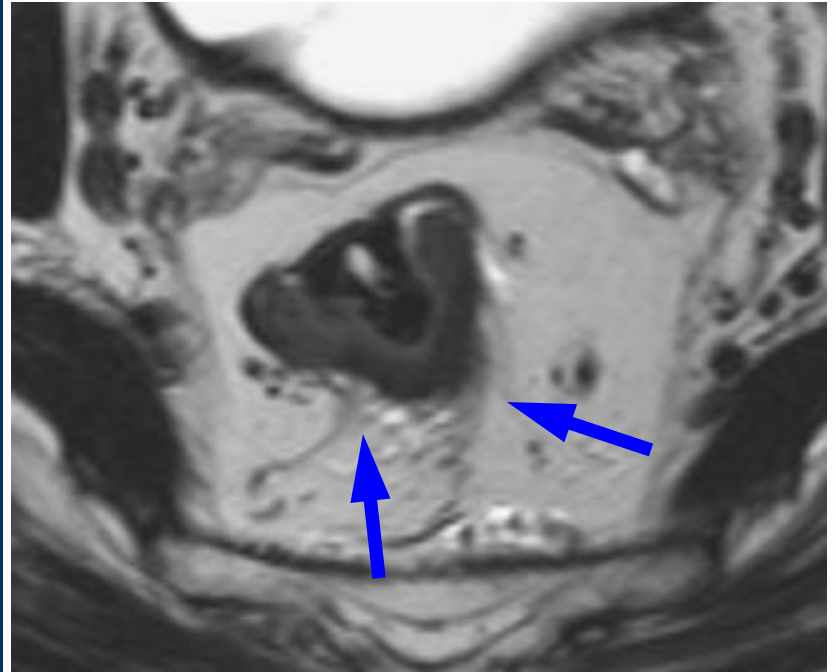
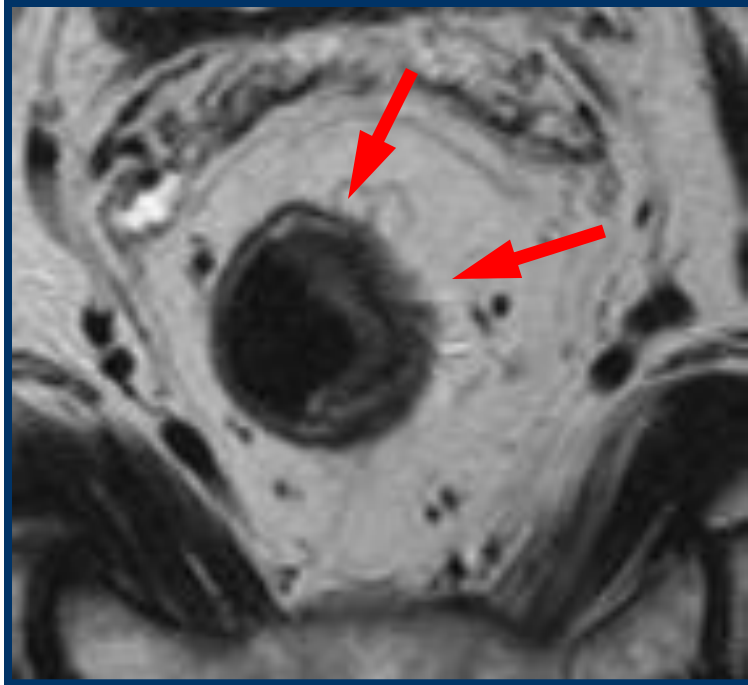


EUS		Sens	Spec
Bipat Radiology 04 Puli Ann S Onc 09	1985-2002 1984-2006	<b>0.94</b> <b>0.88</b>	<b>0.86</b> <b>0.98</b>



MRI PPV 80%



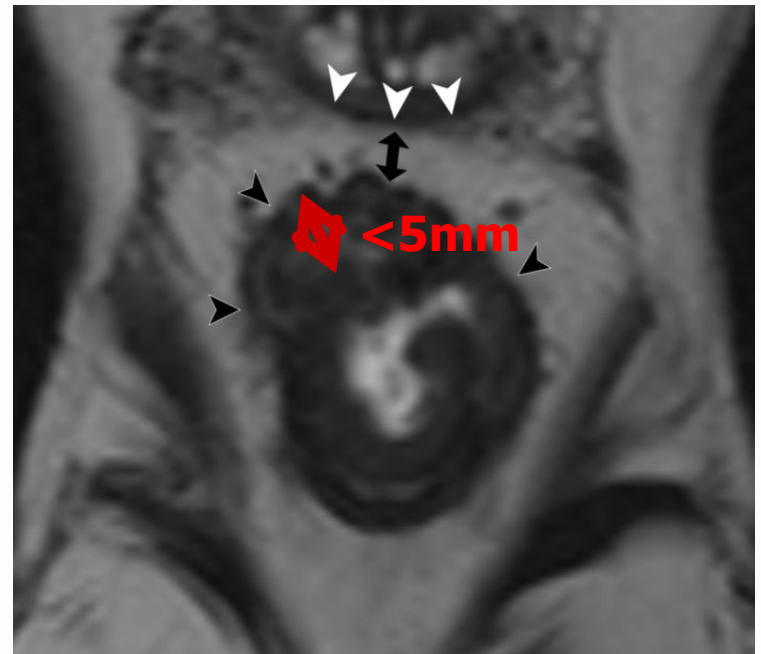
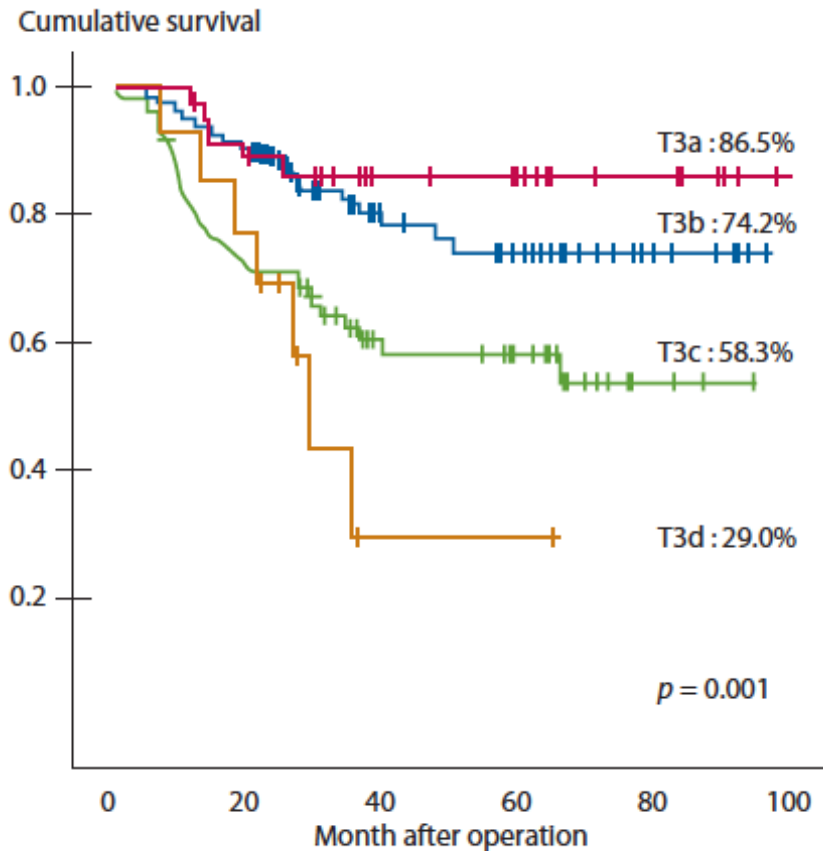


Overstaging 30-40%

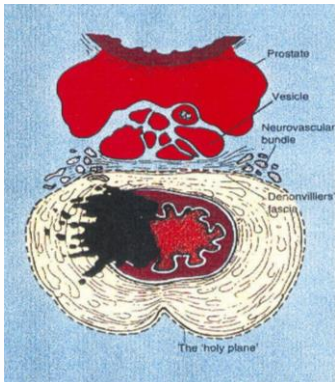
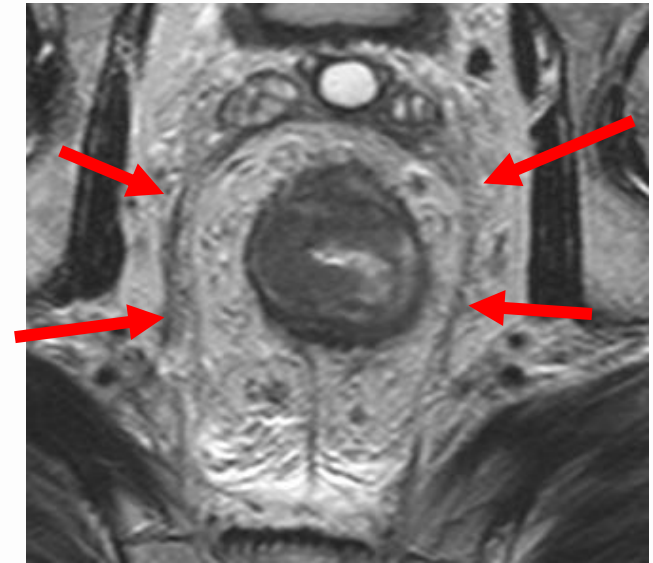
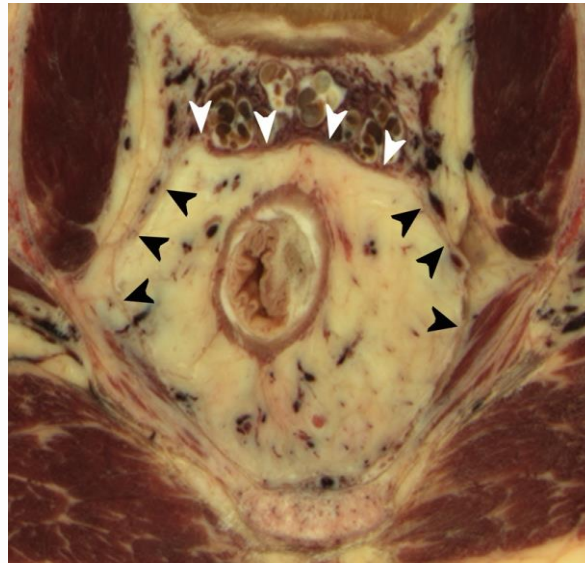


# Heterogeneity T3 tumours

T3a - 1mm - T3b - 5mm - T3c - 15mm - T3d



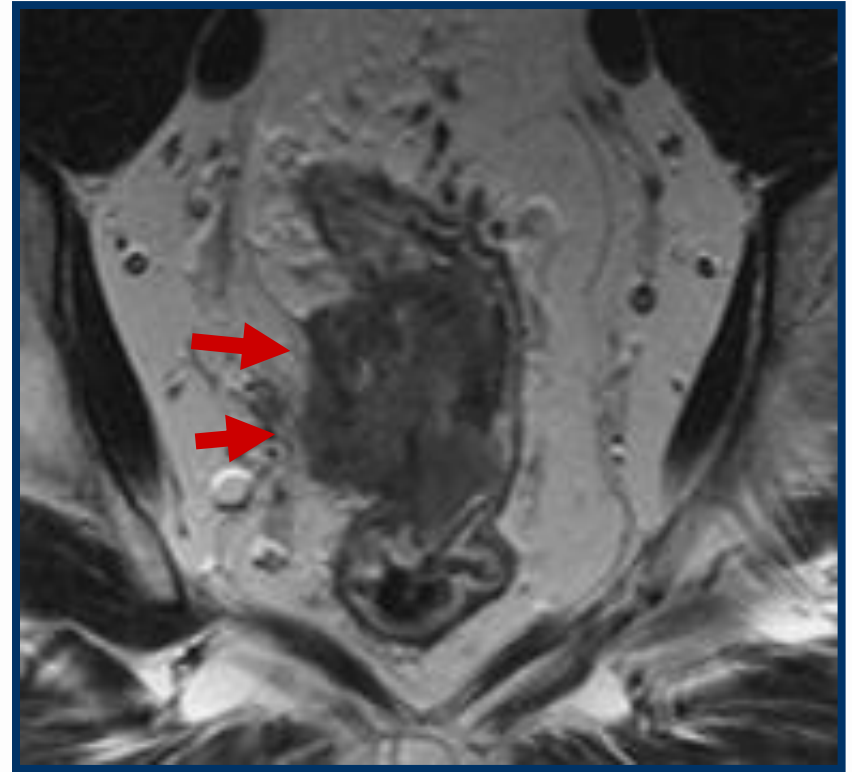
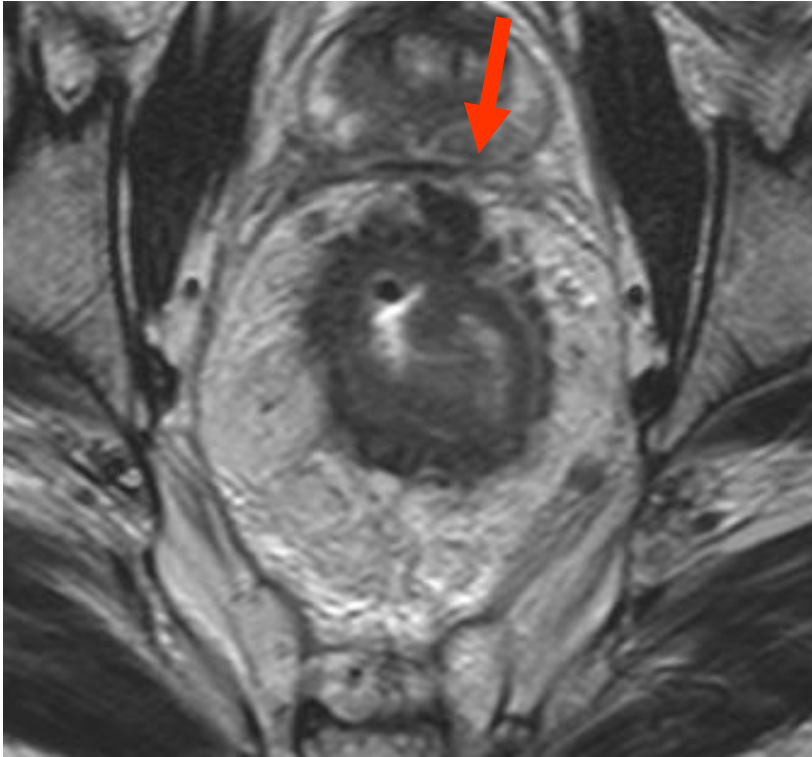
# Mesorectal Fascia involvement



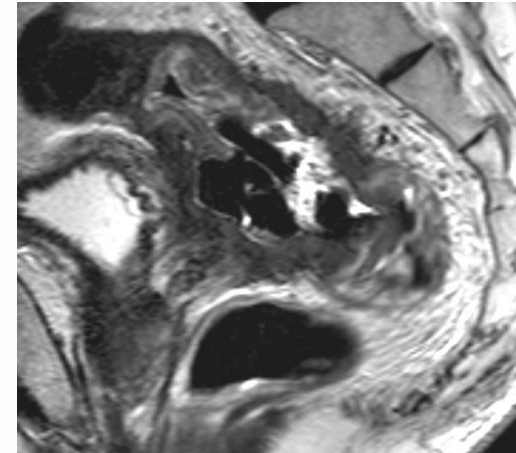
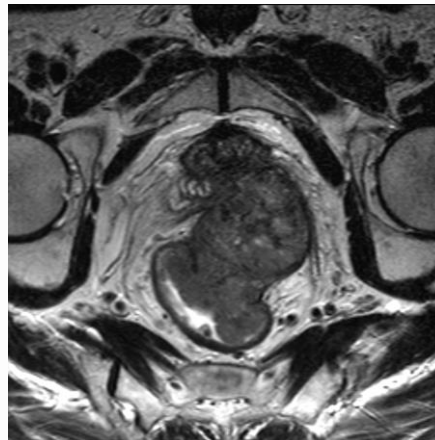
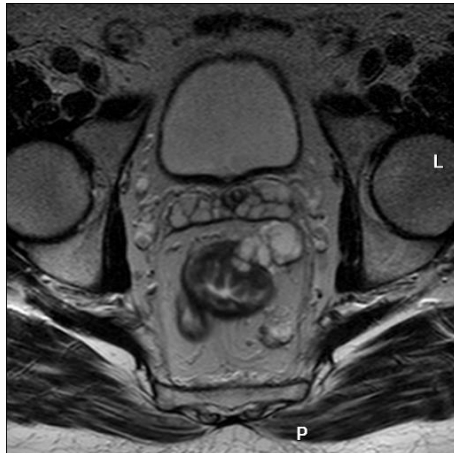
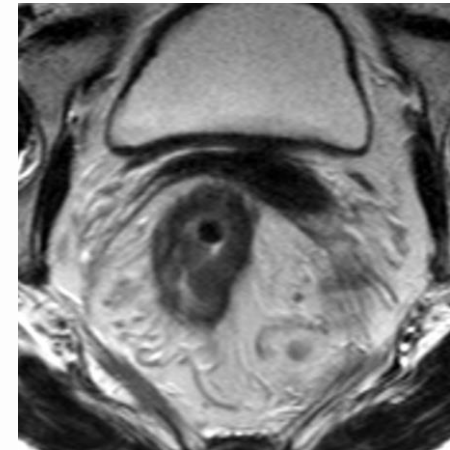
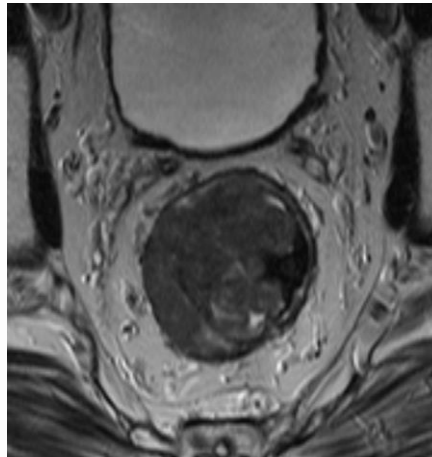
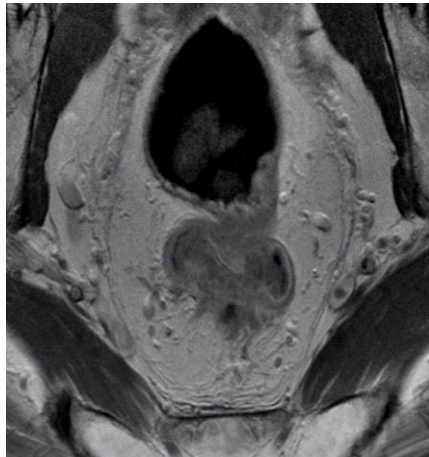
Sens 70 - 90%  
Spec 75 - 100%

Beets-Tan, Lancet 2001  
Mercury trial 2006

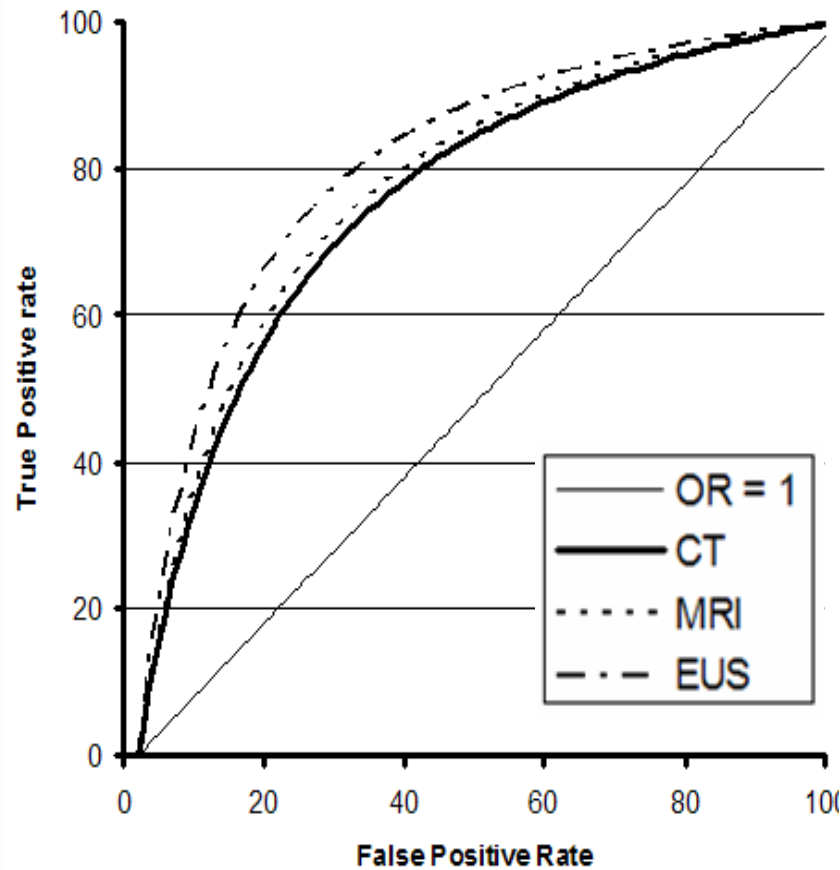
# What You See is What You Get



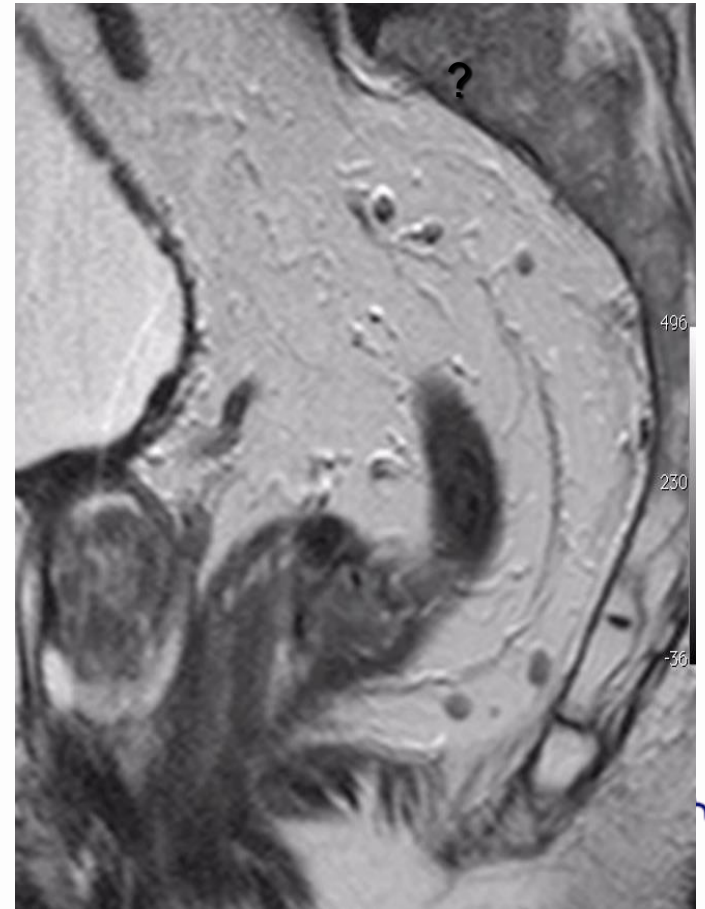
# R0 – Resectable?



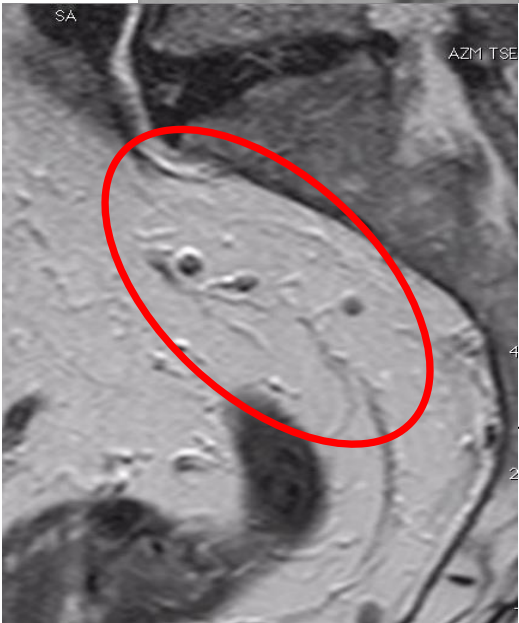
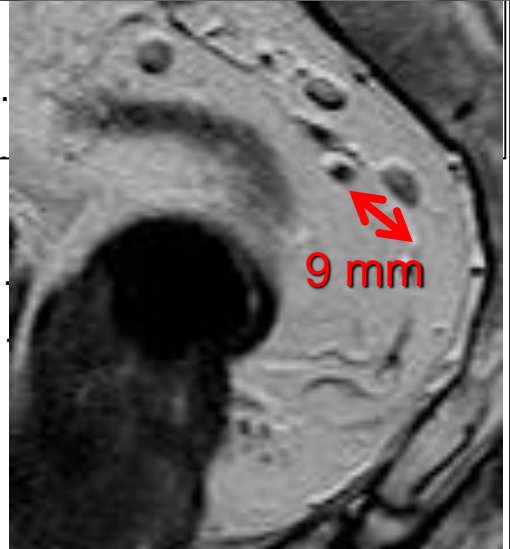
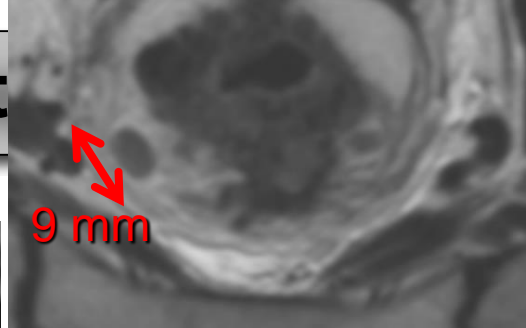
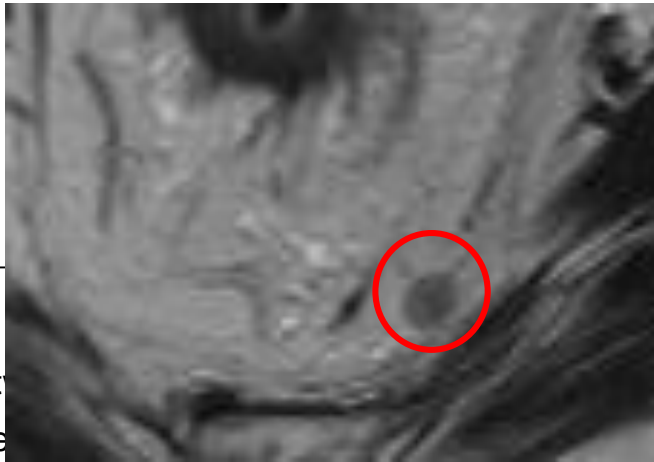
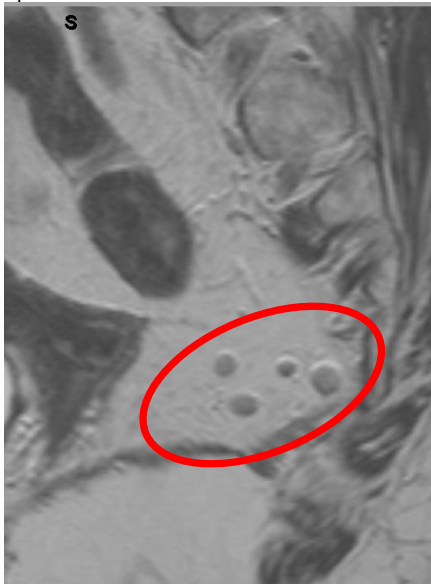
# Primary nodal staging



Lahaye, 2005 et al.



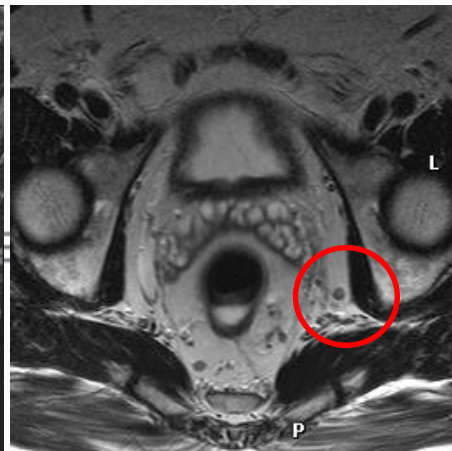
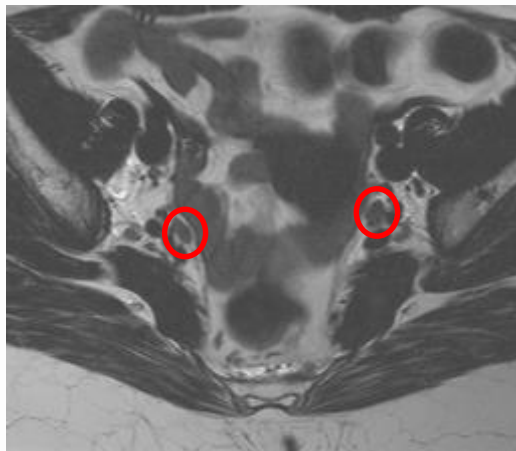
# MRI report primary st



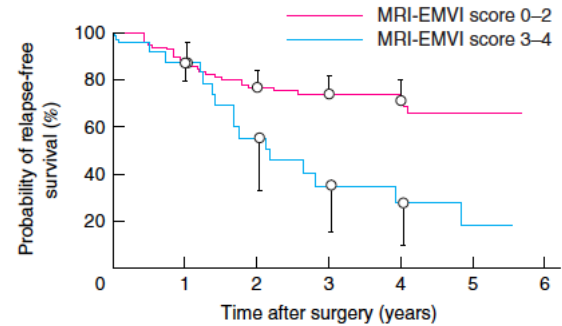
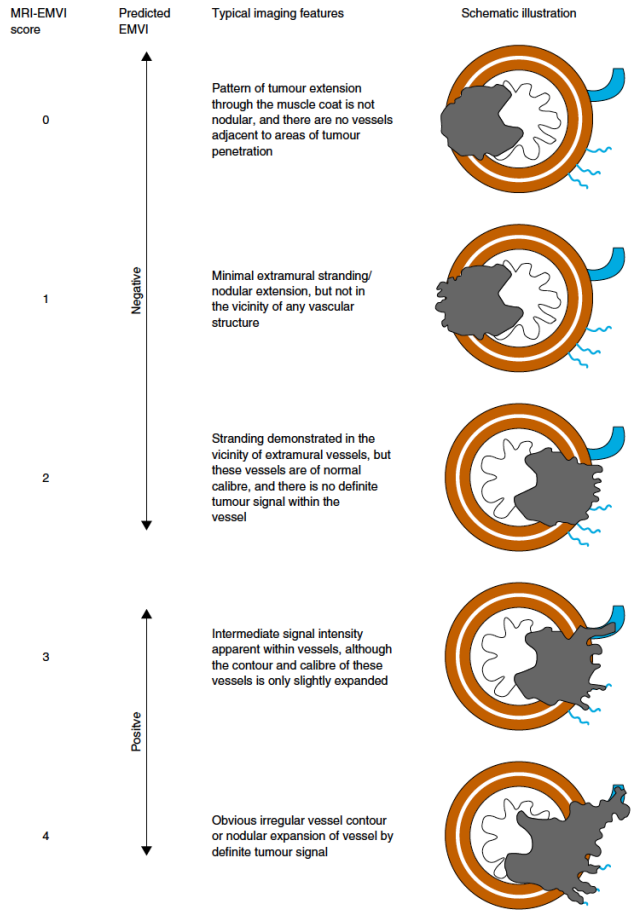
- ~~cN0 (no visible [suspicious] nodes)~~
- ~~cN+ (diameter  $\geq$  9 mm)~~
- ~~cN+ (diameter 5-9 mm **AND** at least 2 of the criteria: round shape/ irregular border contour/ heterogeneous signal intensity)~~
- cN+ (diameter  $<$ 5 mm **AND** round shape **AND** irregular border contour **AND** heterogeneous signal intensity)

# Lateral nodes uncommon?

- Pooled analyses 1216 pts T3/4 distal rectal ca
- 58% visible lateral nodes
- 16% lateral nodes  $\geq 7$  mm
- Kusters et al. JCO 2018 in press



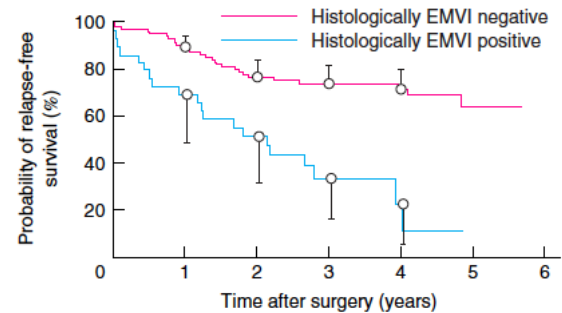
# Extramural venous invasion



No. at risk

MRI-EMVI 0–2	97	84	66	46	27	9
MRI-EMVI 3–4	24	21	12	6	4	1

**a** MRI-EMVI score



No. at risk

EMVI negative	100	88	67	48	29	10
EMVI positive	29	20	14	6	2	

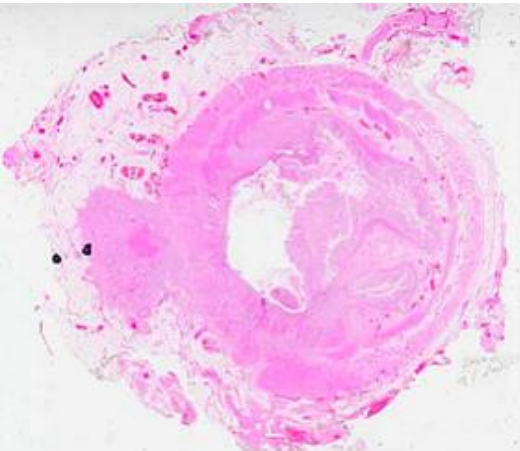
**b** Histological EMVI status



INSTITUTE  
ANTONI VAN LEEUWENHOEK



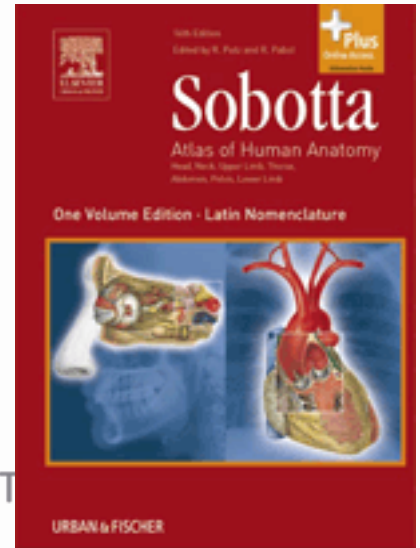
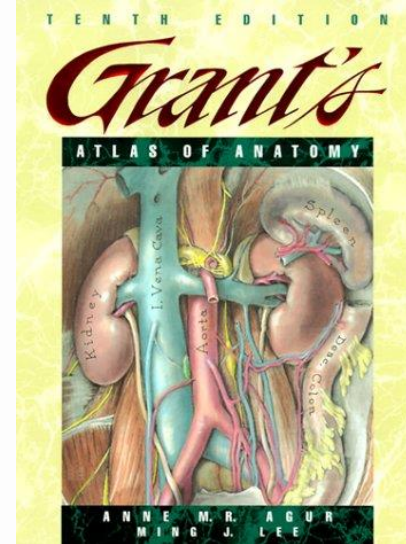
# Extramural venous invasion



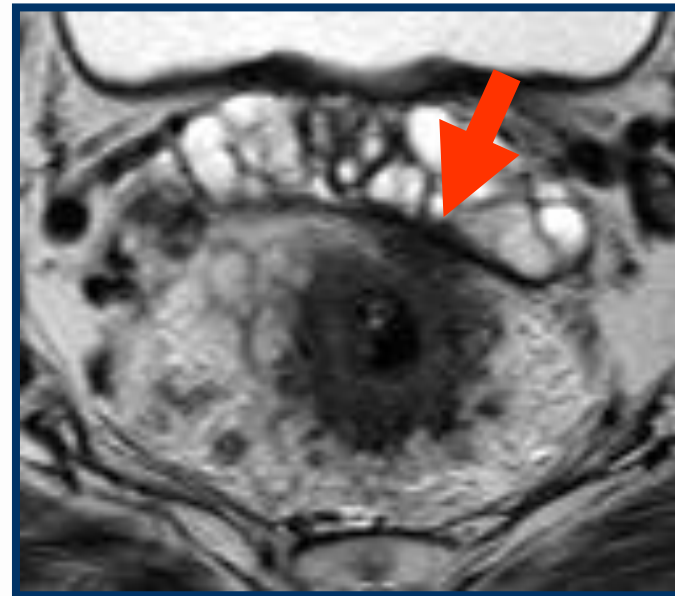
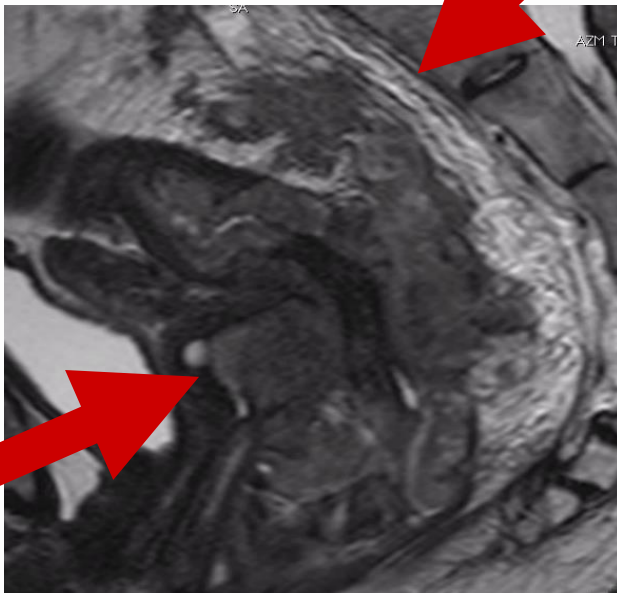
Smith et al. Acta Oncol 2008

- Staging
- **Surgery**
- Assessment of response
- Future developments

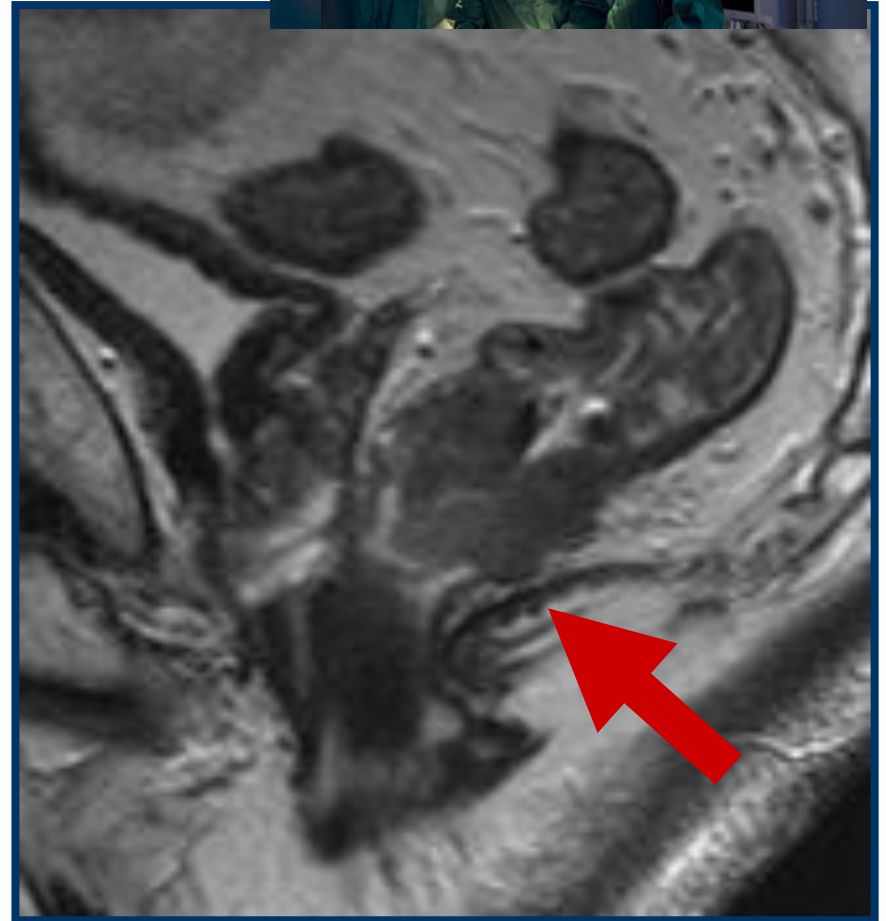
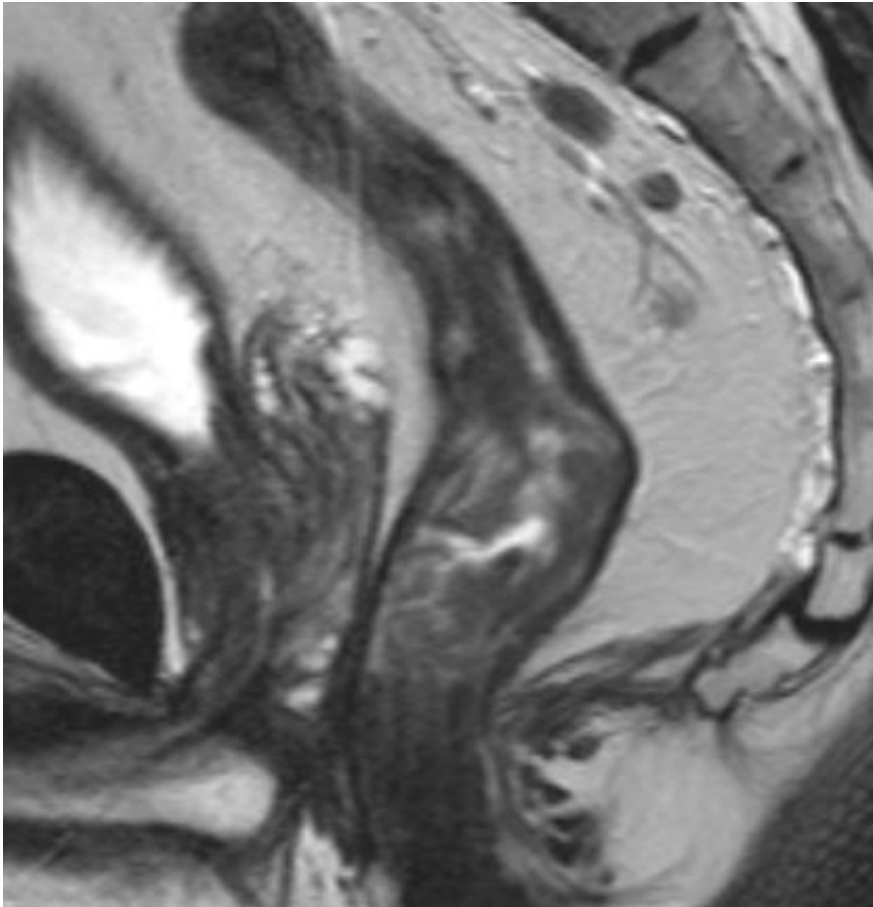
# Anatomy



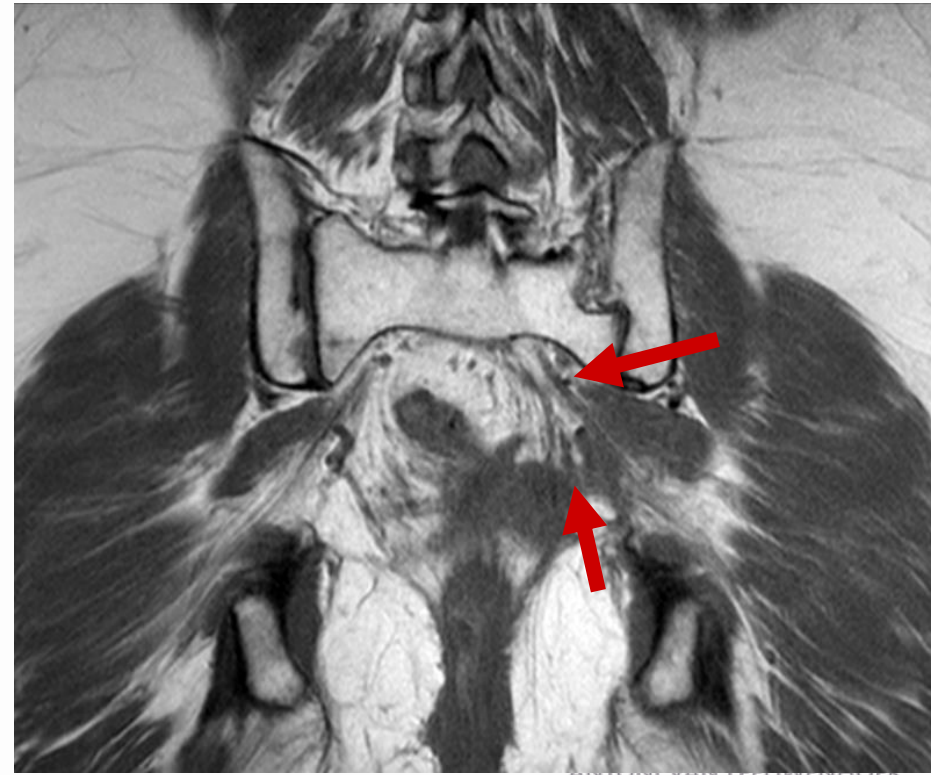
# MRI: GPS for surgeon



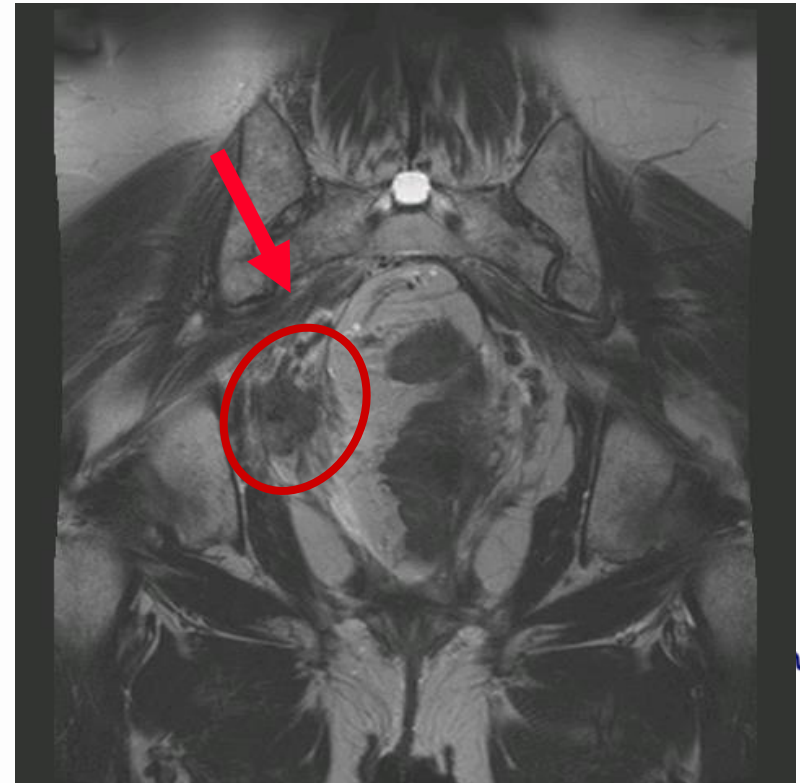
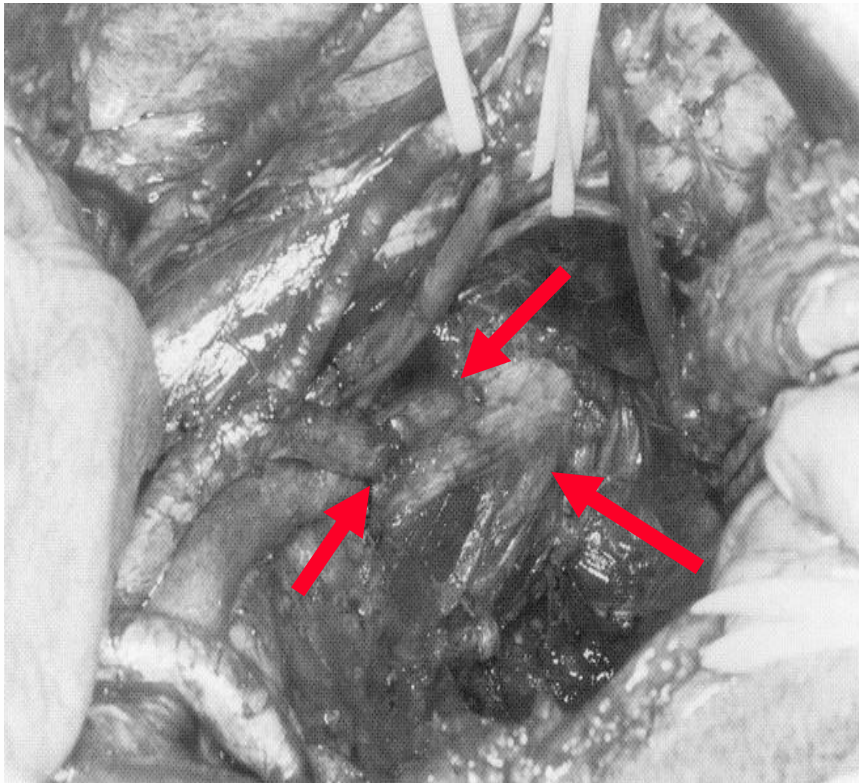
# MRI: GPS for surgeon



# MRI: GPS for surgeon



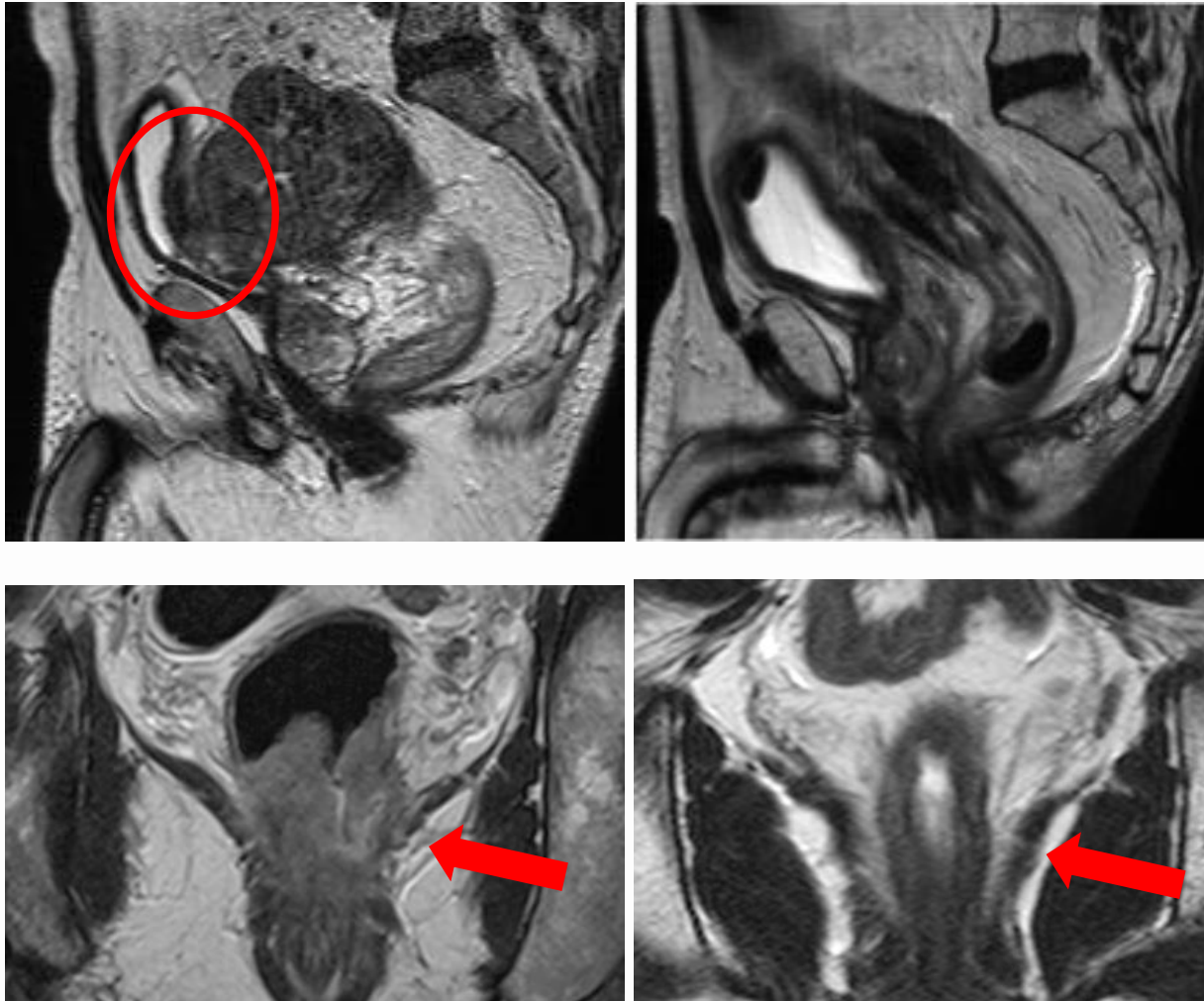
# Pelvic sidewall – IA vessels - nerves



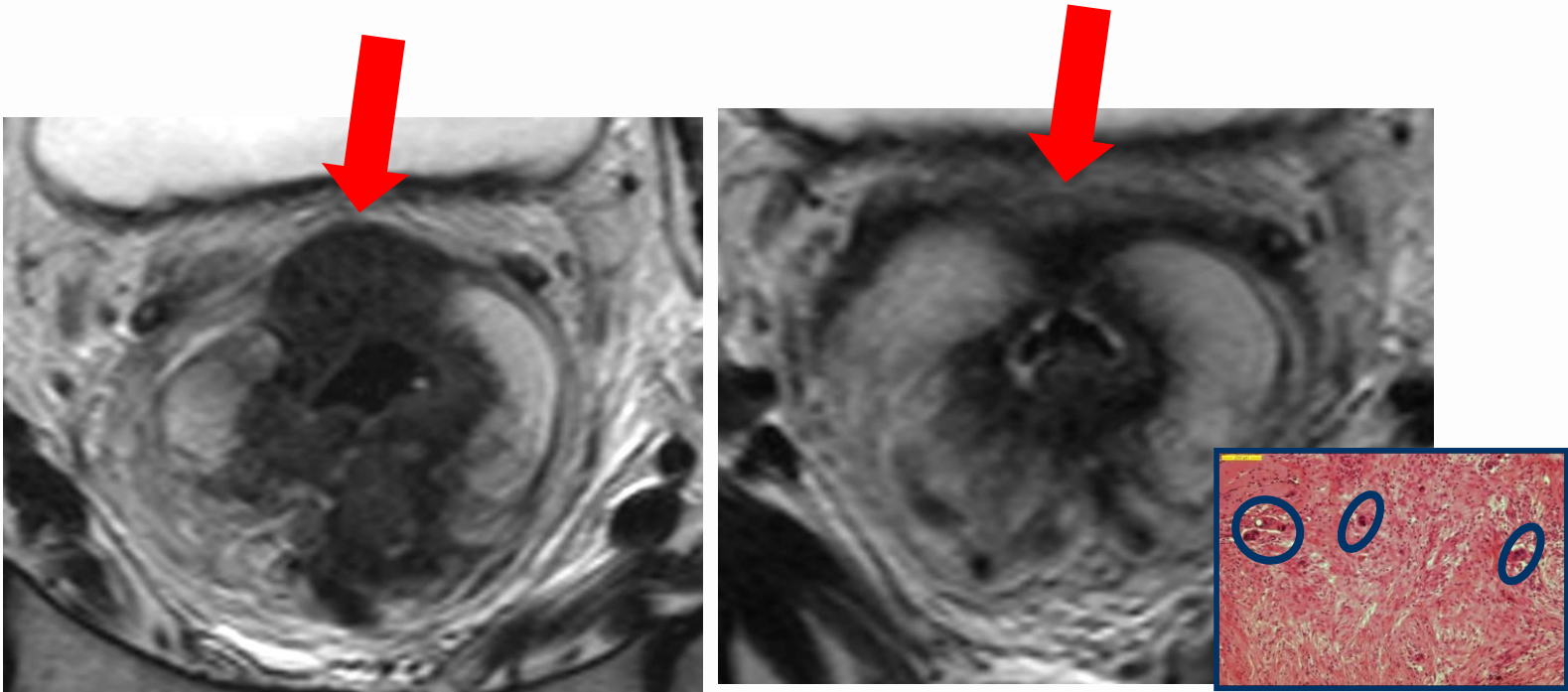
- Staging
- Surgery
- Assessment of response
- Future developments



# Post ChRT: decrease tumor size

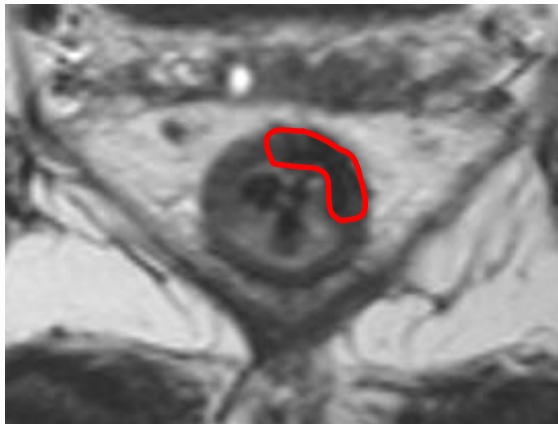
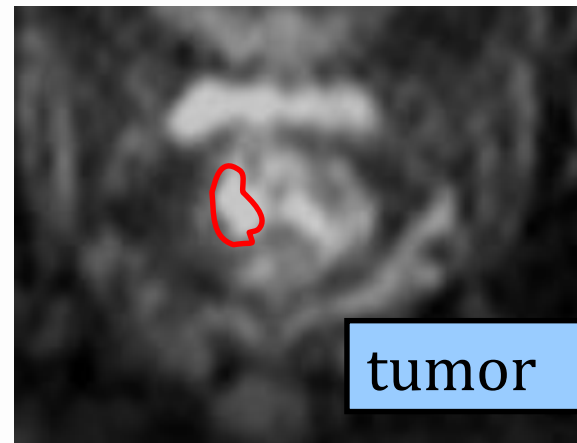
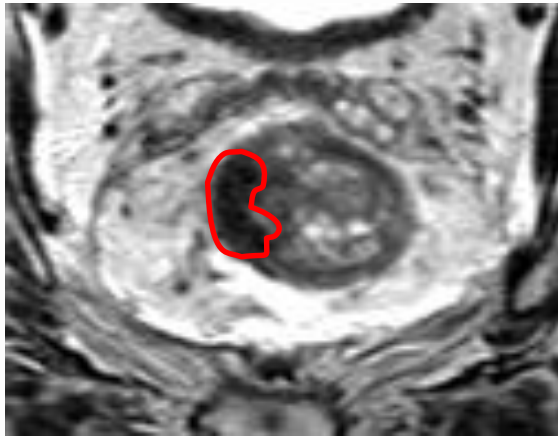


# Problem of fibrosis



Vliegen et al. Radiology 2008  
Mercury BMJ 2006  
Kulkarni et al. Colorectal Dis 2008

# Diffusion MRI increases accuracy pCR

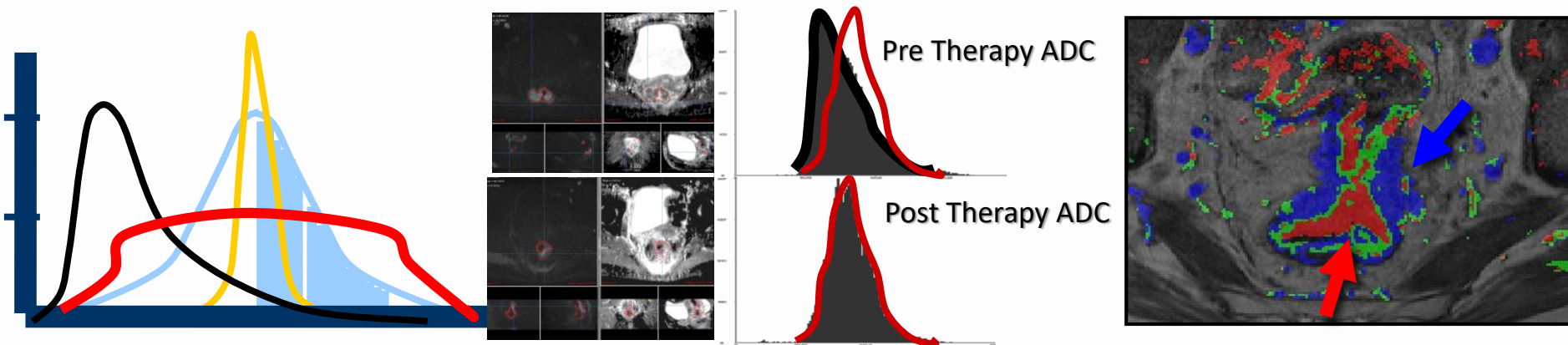


**STANDARD MRI**

**DIFFUSION MRI**

# Future MRI developments

- Lymph node contrast agents (?)
- Functional imaging
  - DWI – DCE
- Early prediction of response
- Characterisation of tumor – radiomics
  - Signal - histogram analysis – perfusion mapping...



# TAKE HOME MESSAGES - 1

- Get familiar with your radiologist
- T2w MRI      ax/sag/cor
  - High definition
  - Large field of view
- Images in operating room
  - GPS for surgeons

# TAKE HOME MESSAGES - 2

- MRI and primary tumor
  - EUS for T1 (expertise)
  - MRI for larger tumours and MRF+
- MRI and lymph nodes
  - good in bulky nodal disease
  - not (yet?) good in small nodal deposits
- MRI restaging: fibrosis!

