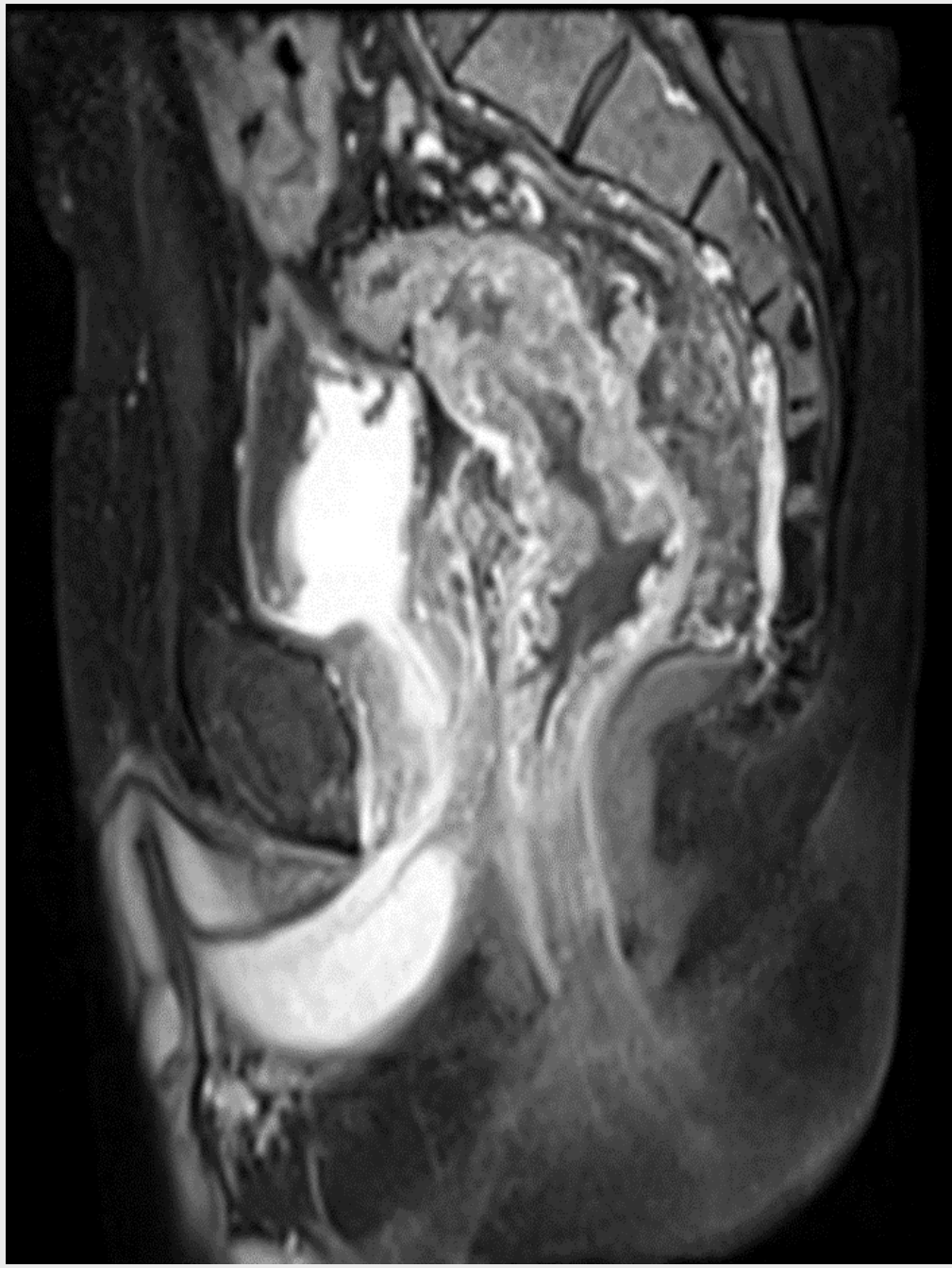
Rectal cancer local staging by MRI



BY

Dr. Dr.Hiba Mohammed Abdulwahid

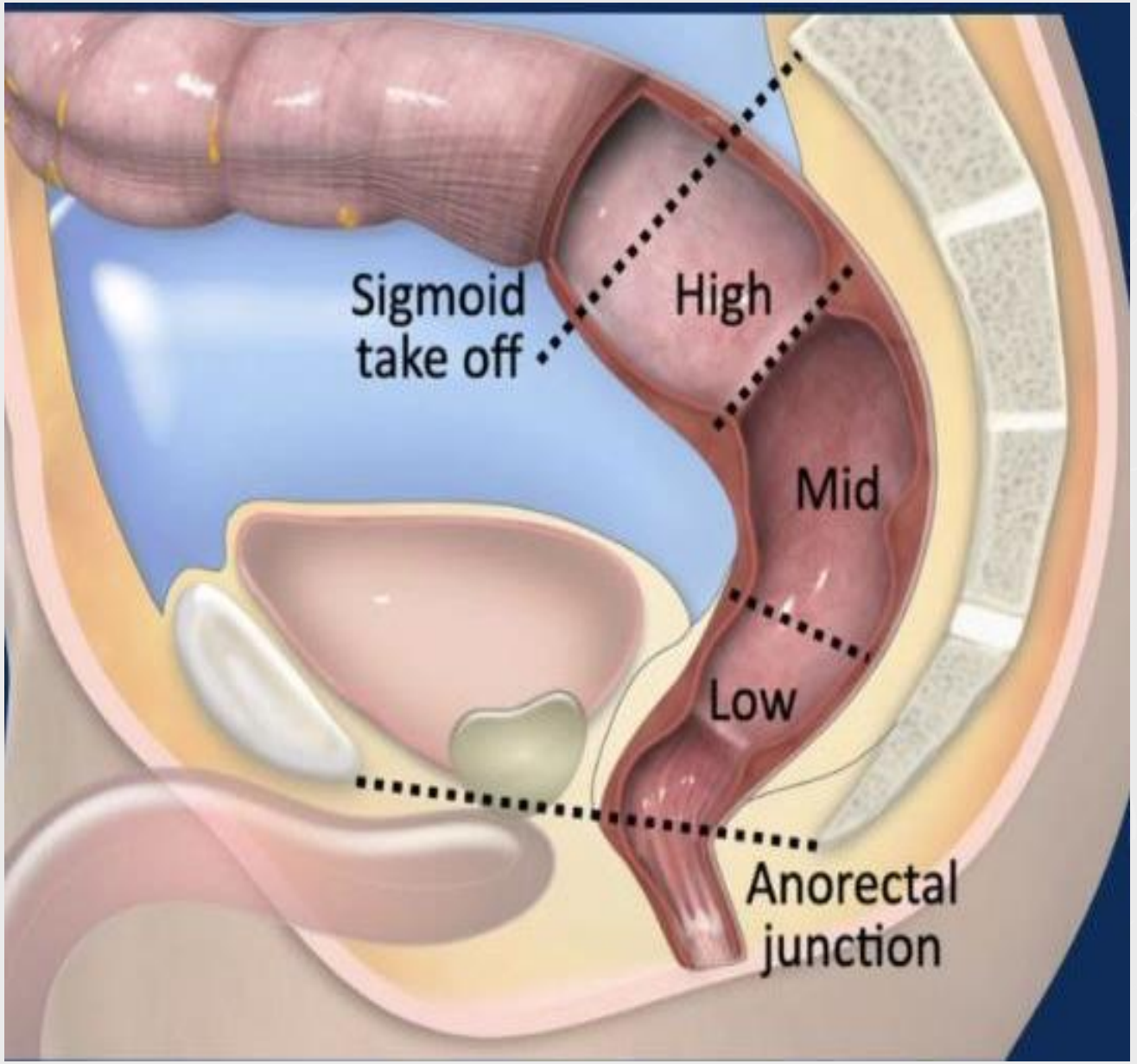
CABMS-RAD

College of Medicine /University of Baghdad

Colonic or rectal

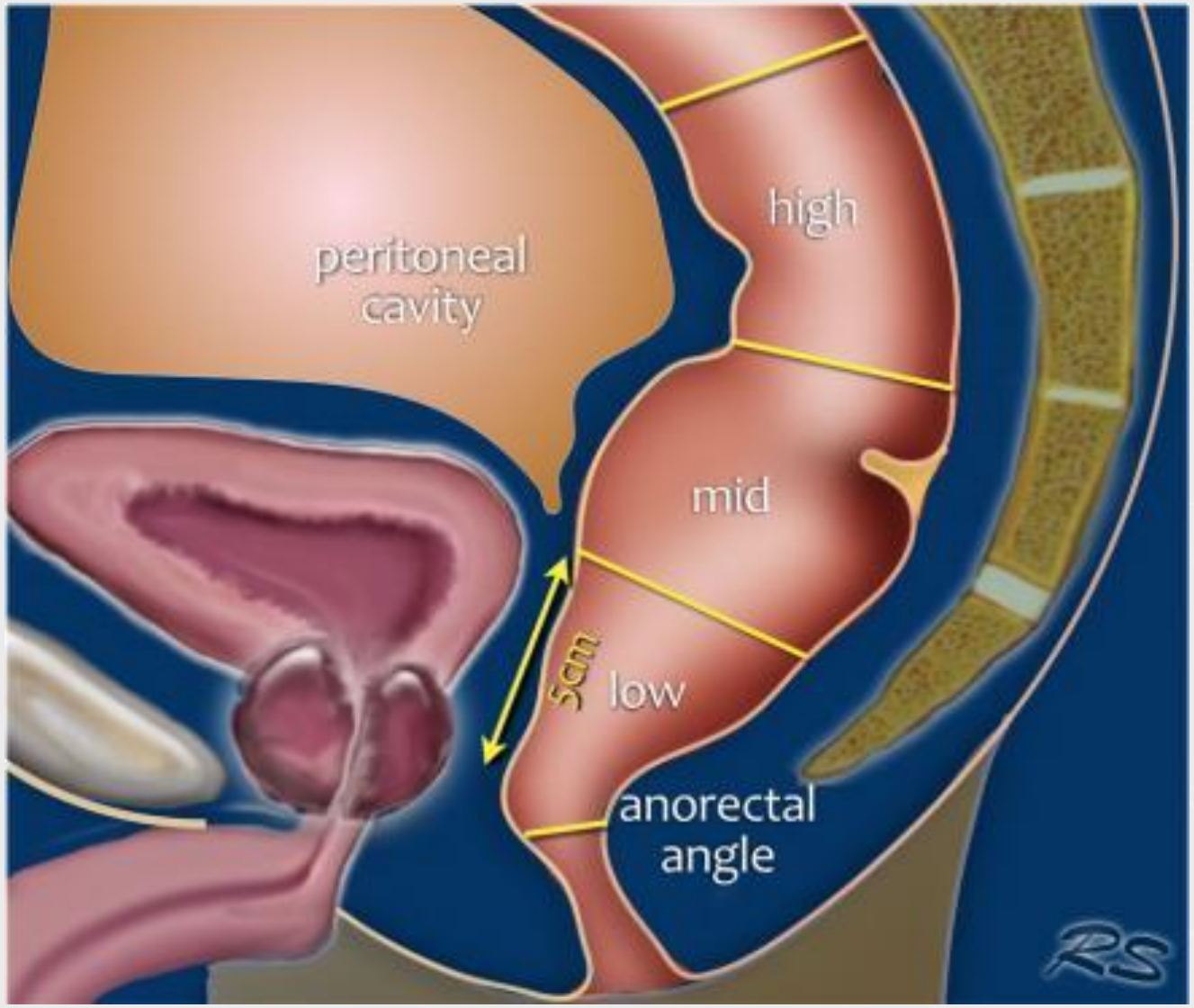
Sigmoid take-off

- Where the sigmoid courses horizontally away from the sacrum.
- Discriminating rectal from sigmoid cancer is important because the treatment approach differs considerably.
- Routine treatment for sigmoid cancer is resection, while rectal tumours undergo differentiated treatments varying from. surgery (with TME) in low risk tumors to long course neoadjuvant chemoradiotherapy in high risk tumors



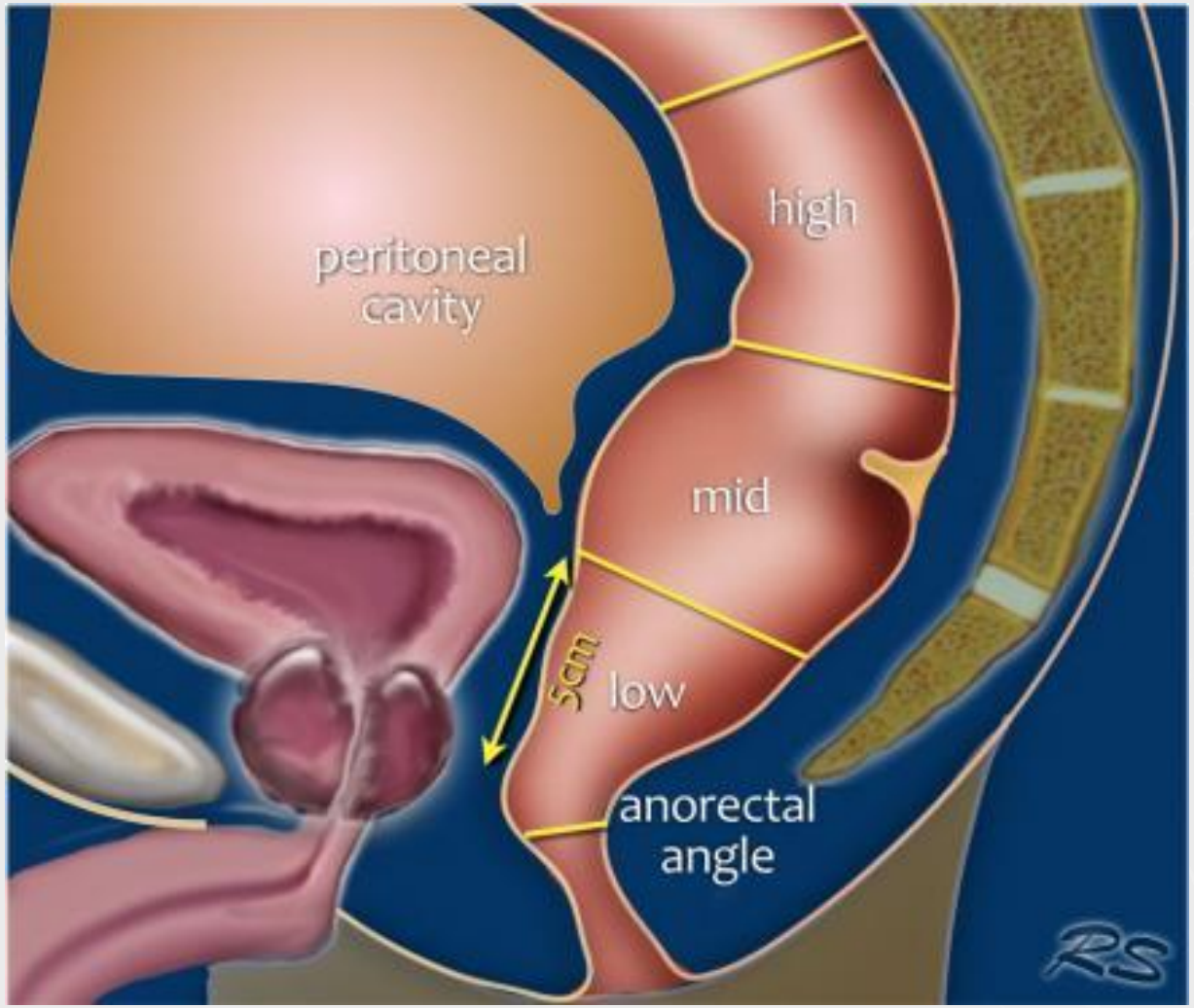
The rectum extends from the anorectal junction to the sigmoid.
The recto-sigmoid junction is subjectively defined as 15 cm above the anorectal angle.

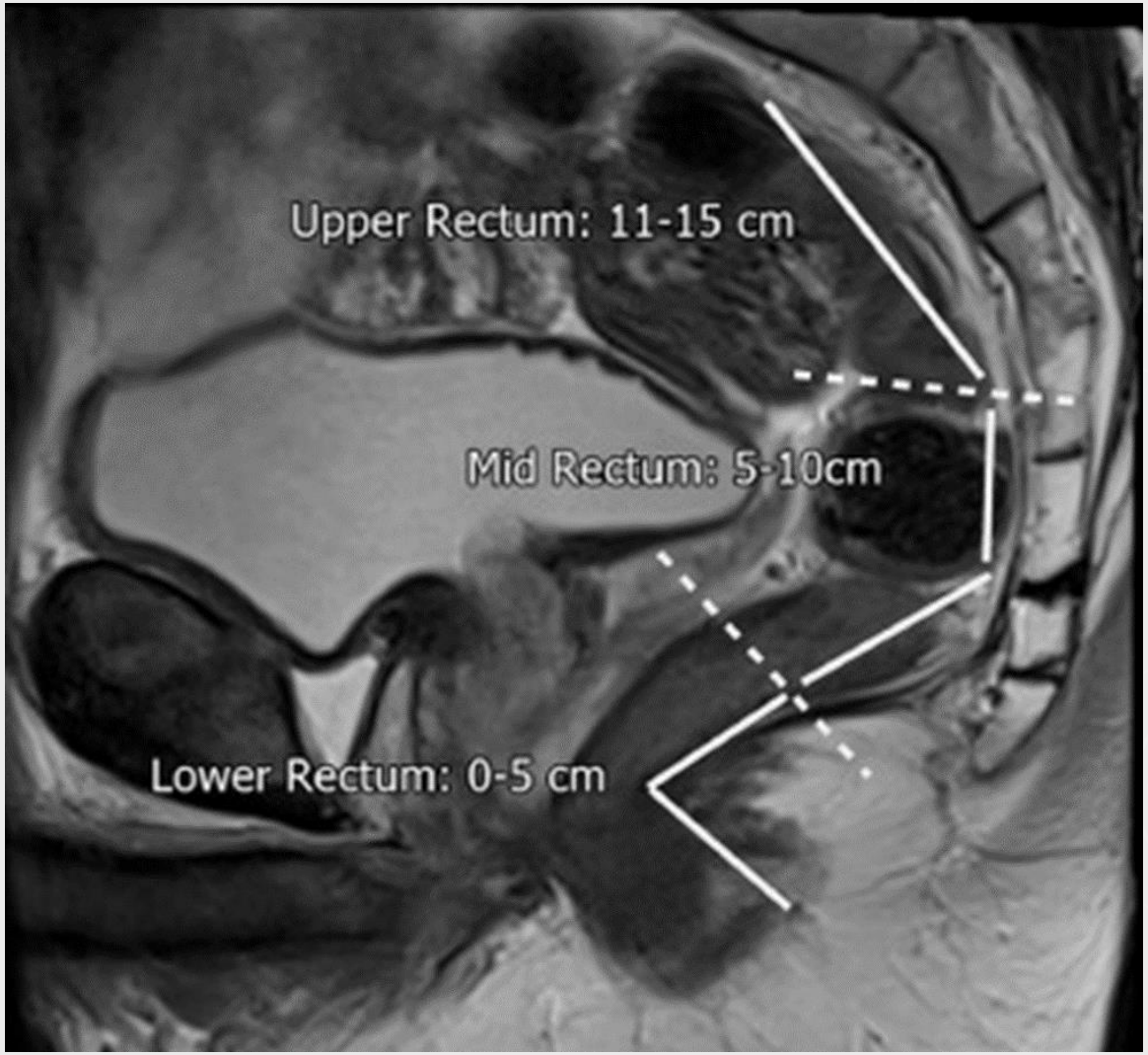
A tumor more than 15 cm above the anorectal angle is regarded and treated as a sigmoid tumor.



Rectal cancer can be divided into:

- **Low rectal cancer:**
Distal border is 0- 5 cm from the anorectal angle
- **Mid rectal cancer:**
Distal border is 5-10 cm from the anorectal angle
- **High rectal cancer:**
Distal border is 10-15 cm from the anorectal angle




Upper Rectum: 11-15 cm
Mid Rectum: 5-10cm
Lower Rectum: 0-5 cm

Protocols for the imaging examination of patients with colonic cancer

- **If the tumor is located in the colon**, the initial staging will be done through **abdominal ultrasound and thoraco-abdomino-pelvic CT.**

Staging of colonic cancer

- **By analyzing the T stage, it is known that CT is not able to easily differentiate between T1/T2 tumors.**
- **T1/T2 tumors present as asymmetric focal thickenings of the colonic wall, with smooth external contours.**
- **T3 tumors : show protrusion or bulging of the contours of the external surface of the intestinal wall, irregularities in its contour or frank signs of direct tumor extension with pericolic fat infiltration.**
- **Tumors of T4 classification infiltrate the visceral peritoneum of adjacent organs and maintain an intimate relationship with other organs.**

Protocols for the imaging examination of the patient with rectal cancer

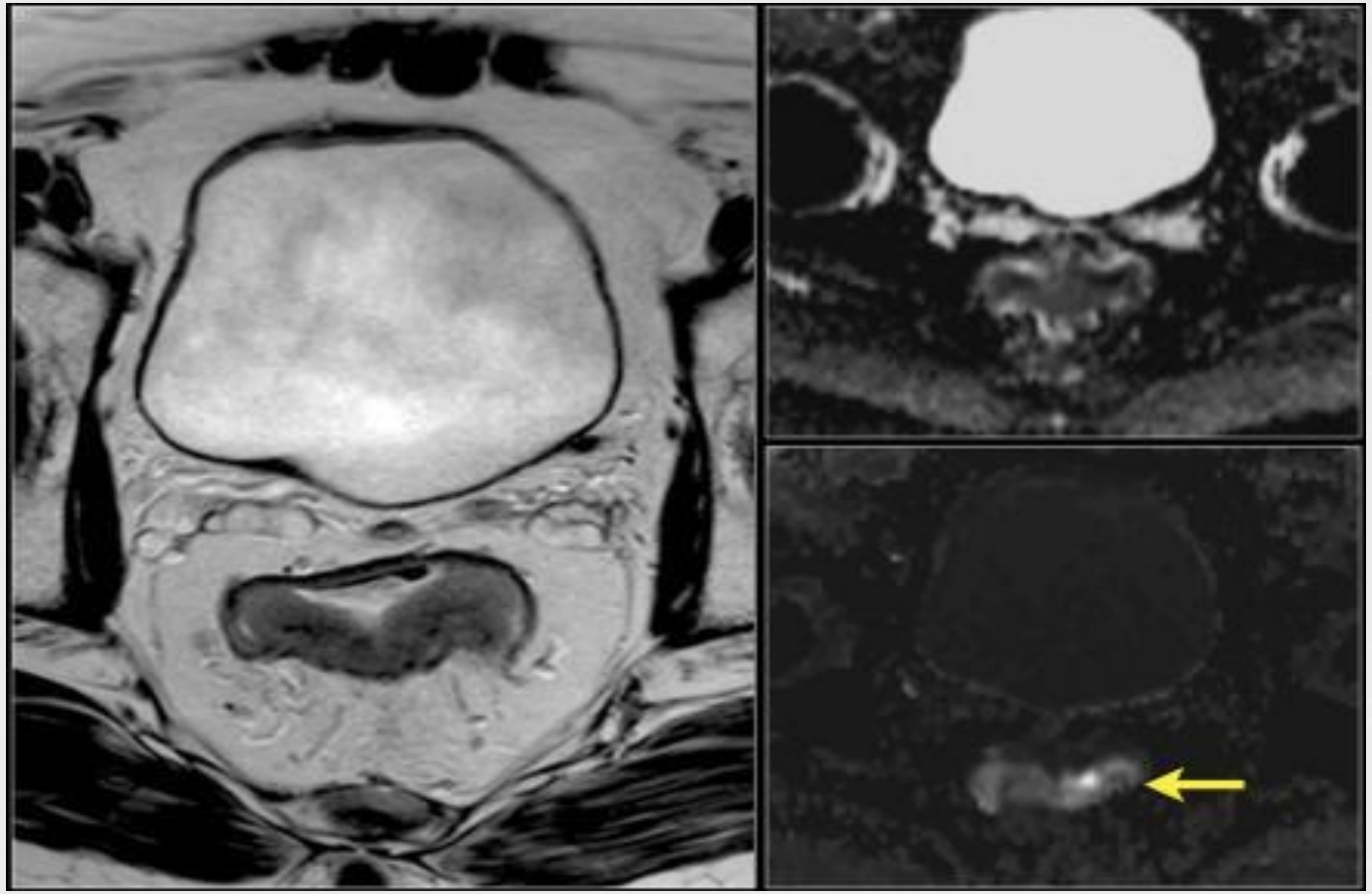
The **rectal tumors** will benefit from the **high-resolution pelvic MRI or transrectal ultrasound for their initial staging**.

MRI PROTOCOL

-High resolution 2D T2-weighted fast spin echo sequences are required.

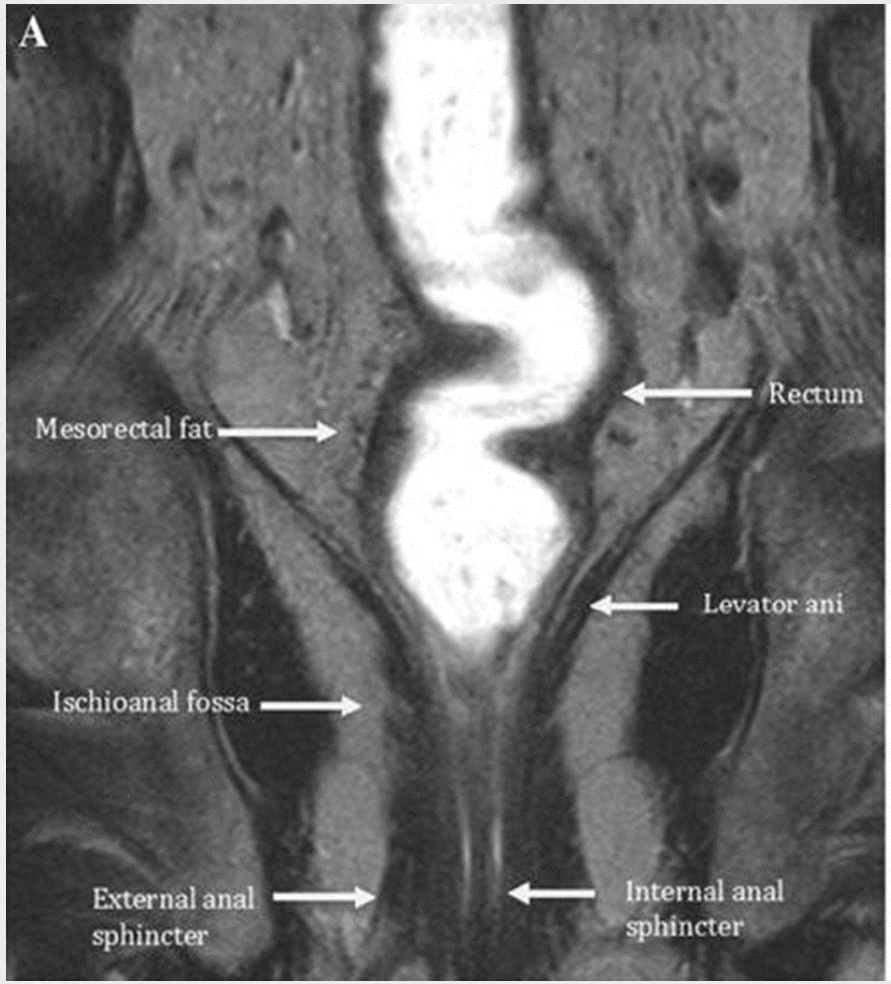
--Gadolinium-enhanced MR **does not** improve diagnostic accuracy and is not included in the protocol.

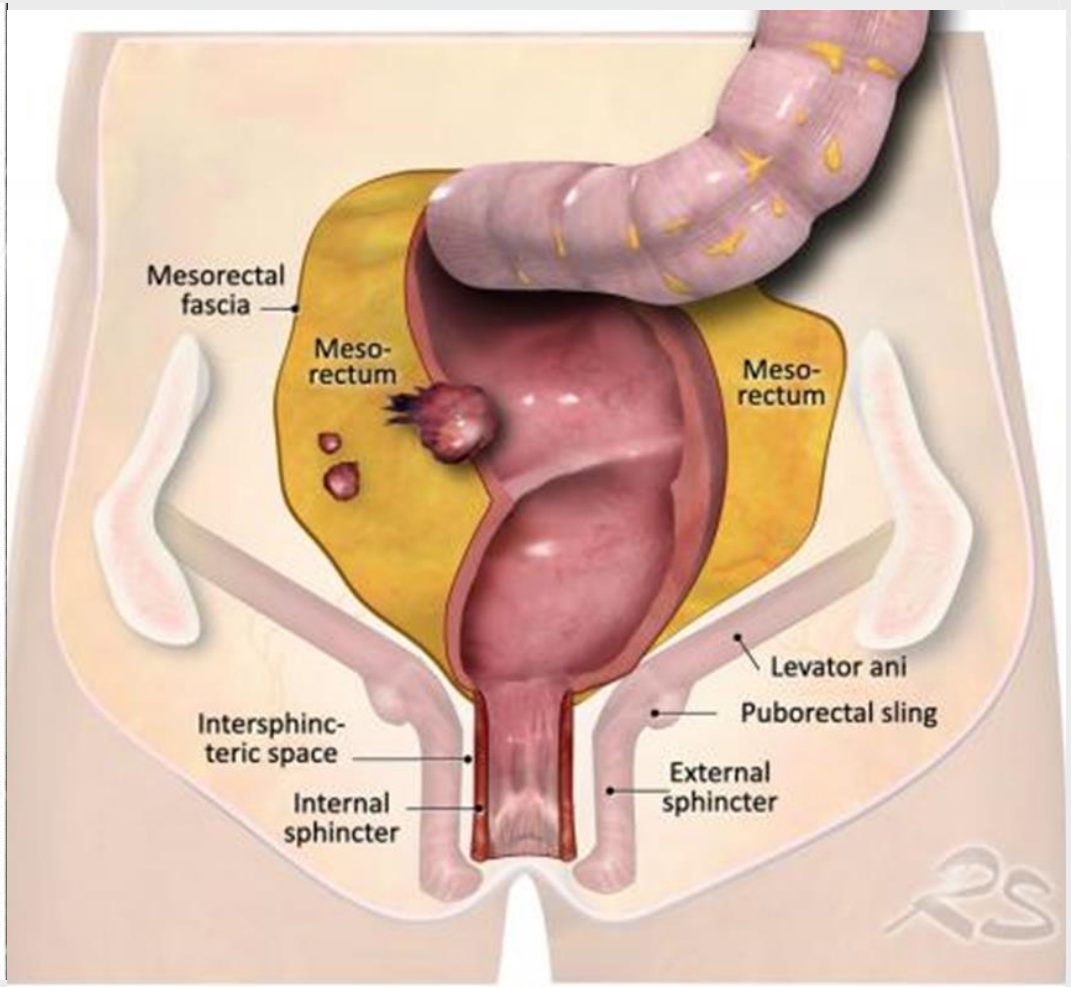
DWI can be useful for **tumor and lymph node detection** in primary staging.



Semicircular T3 tumor with perirectal invasion extending from 3-9 o'clock of the circumference.
Corresponding diffusion restriction on the ADC map and calculated DWI (b = 1000 s/mm2)

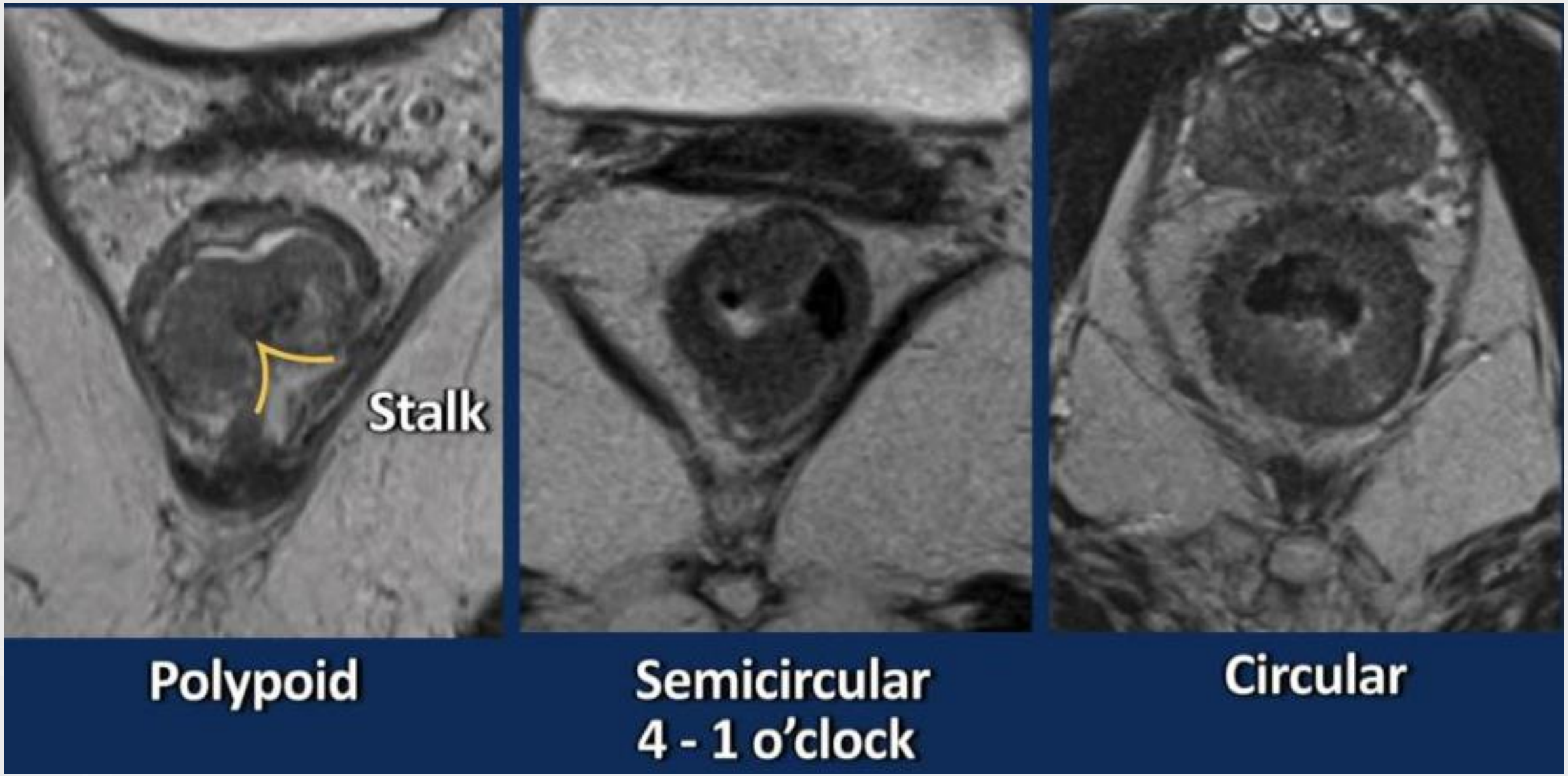
Coronal Anatomy





Tumor parameters

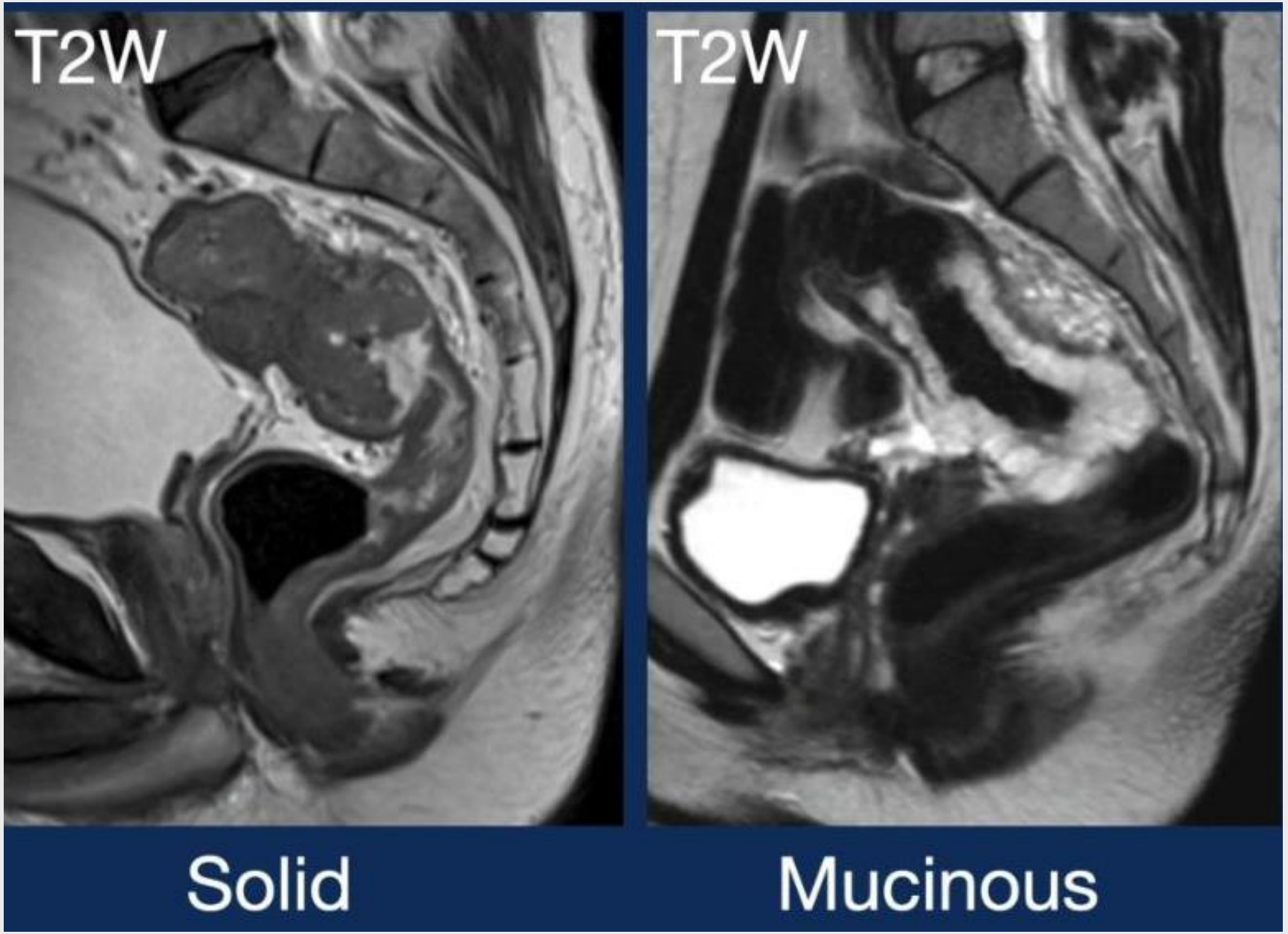
Morphology…



Consistency…

mucinous adenocarcinomas have a **poorer prognosis** because it shows poorer response to neoadjuvant treatment.

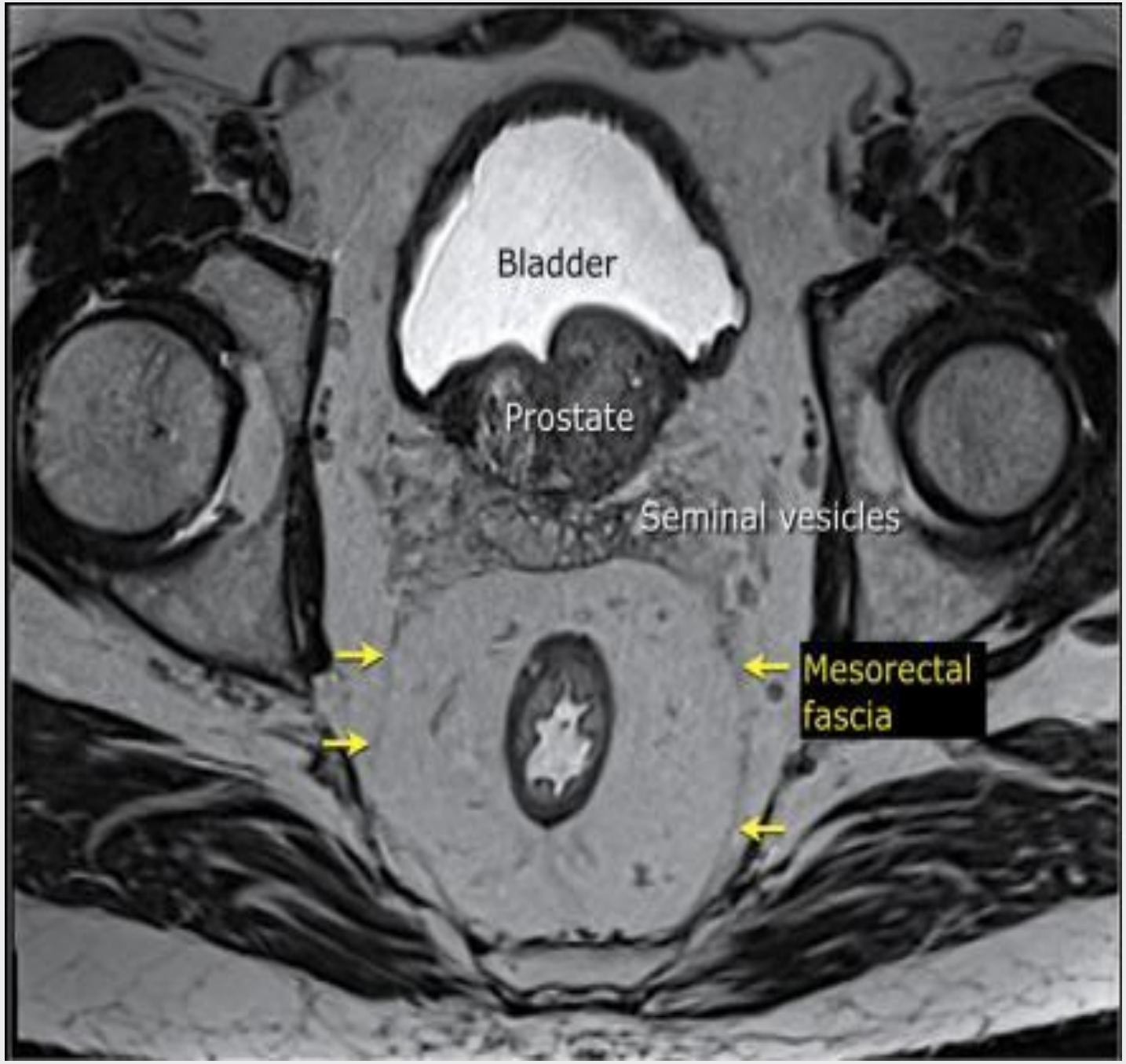
Mucinous tumors show distinct bright signal on T2-weighted MRI compared to the more intermediate signal of solid type tumors.



The mesorectal fascia (MRF)

- Plays a crucial role in the treatment planning.

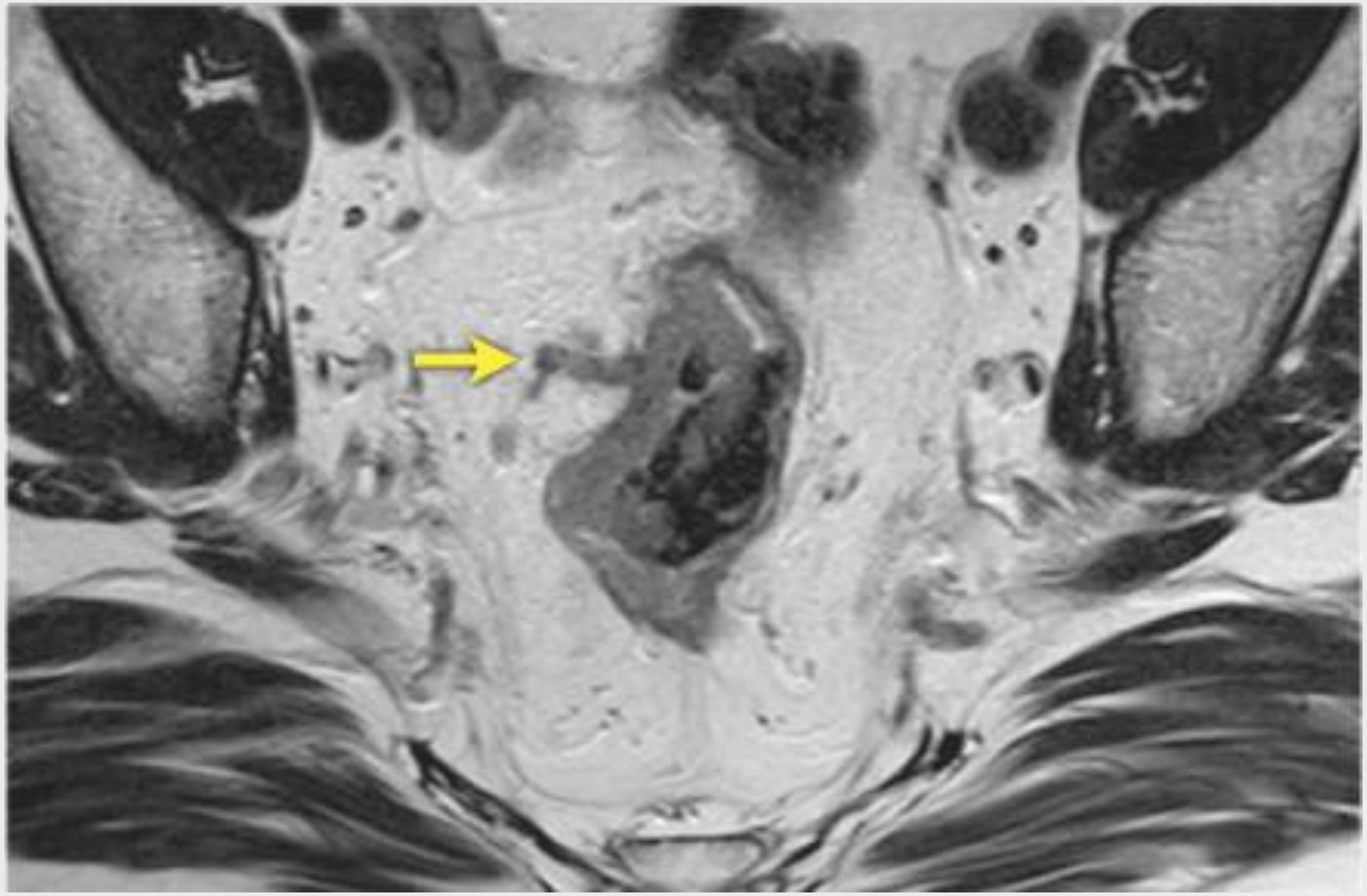
- In Total mesorectal excision (TME) the mesorectal fascia is the resection plane and it has to be tumor-free.
  A distance of the tumor to the mesorectal fascia of **⩽1 mm** is regarded as **not suitable** for TME and is called an *involved MRF.*



Extramural vascular invasion (EMVI)

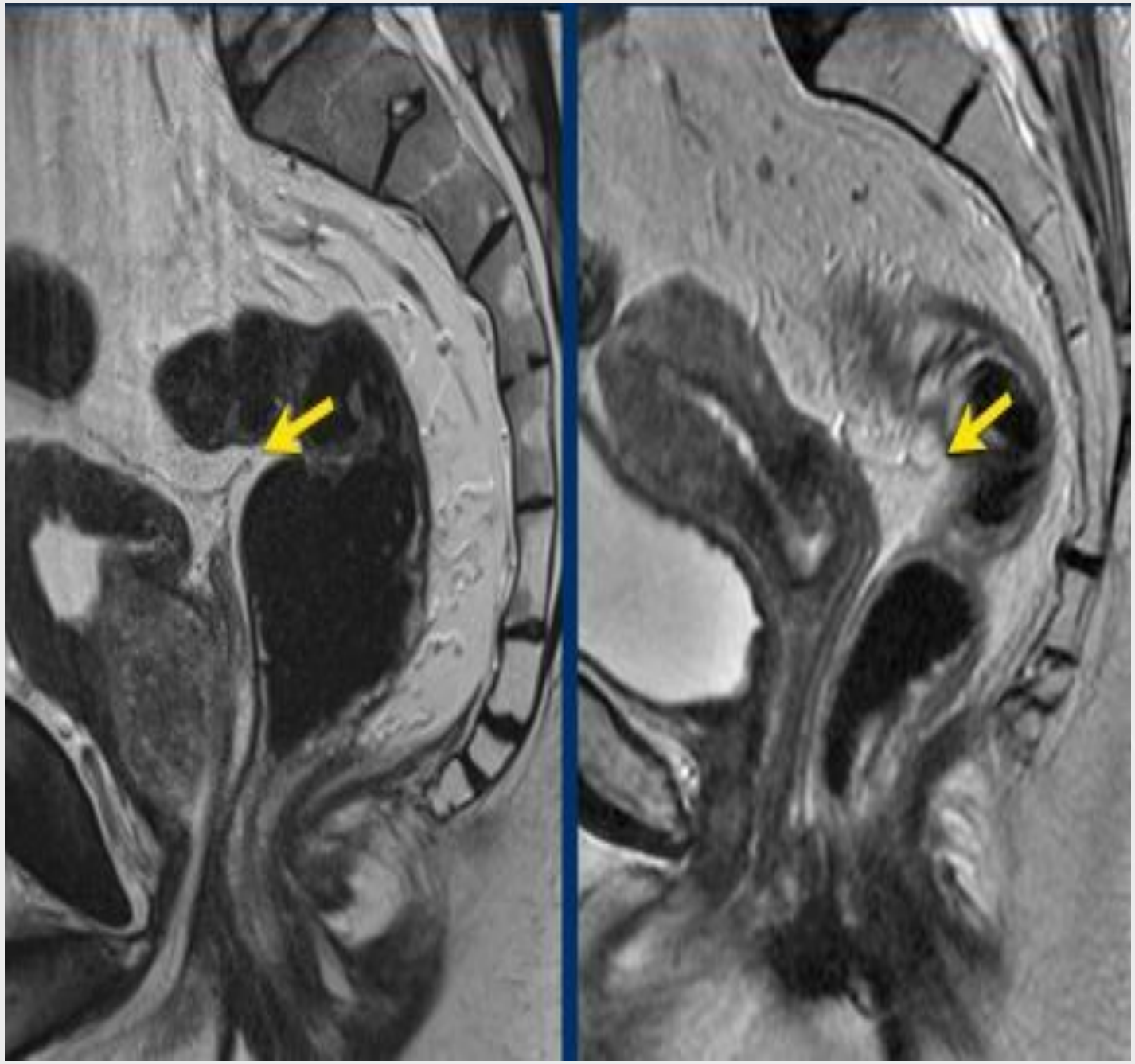
Vascular invasion is a risk factor for recurrent disease hence should be included in standardized MR reporting.

EMVI is associated with T3- and T4 tumors.



Anterior peritoneal reflection

On sagittal T2-weighted images the peritoneal reflection can be recognized as a hypointense V-shaped thin line



TNM-stage

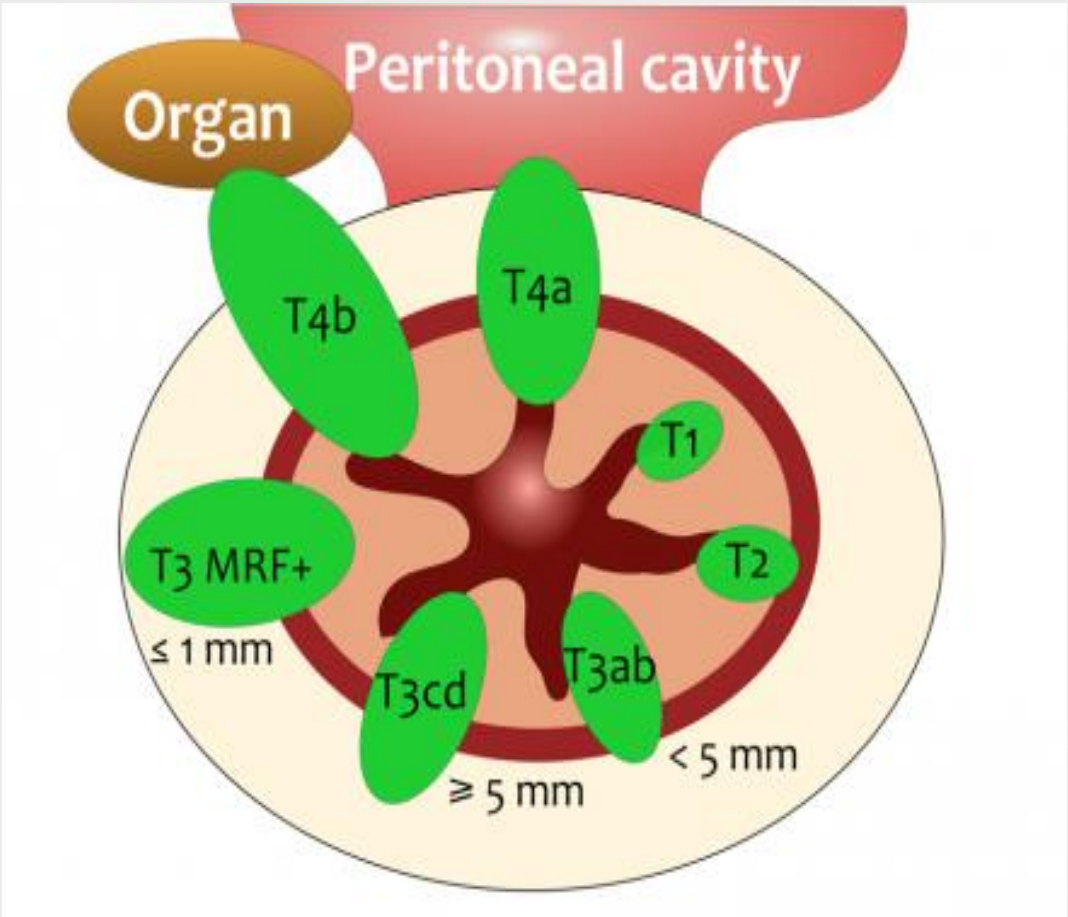
The treatment of a patient with rectal cancer depends on the TNM-stage and whether the MRF is involved.

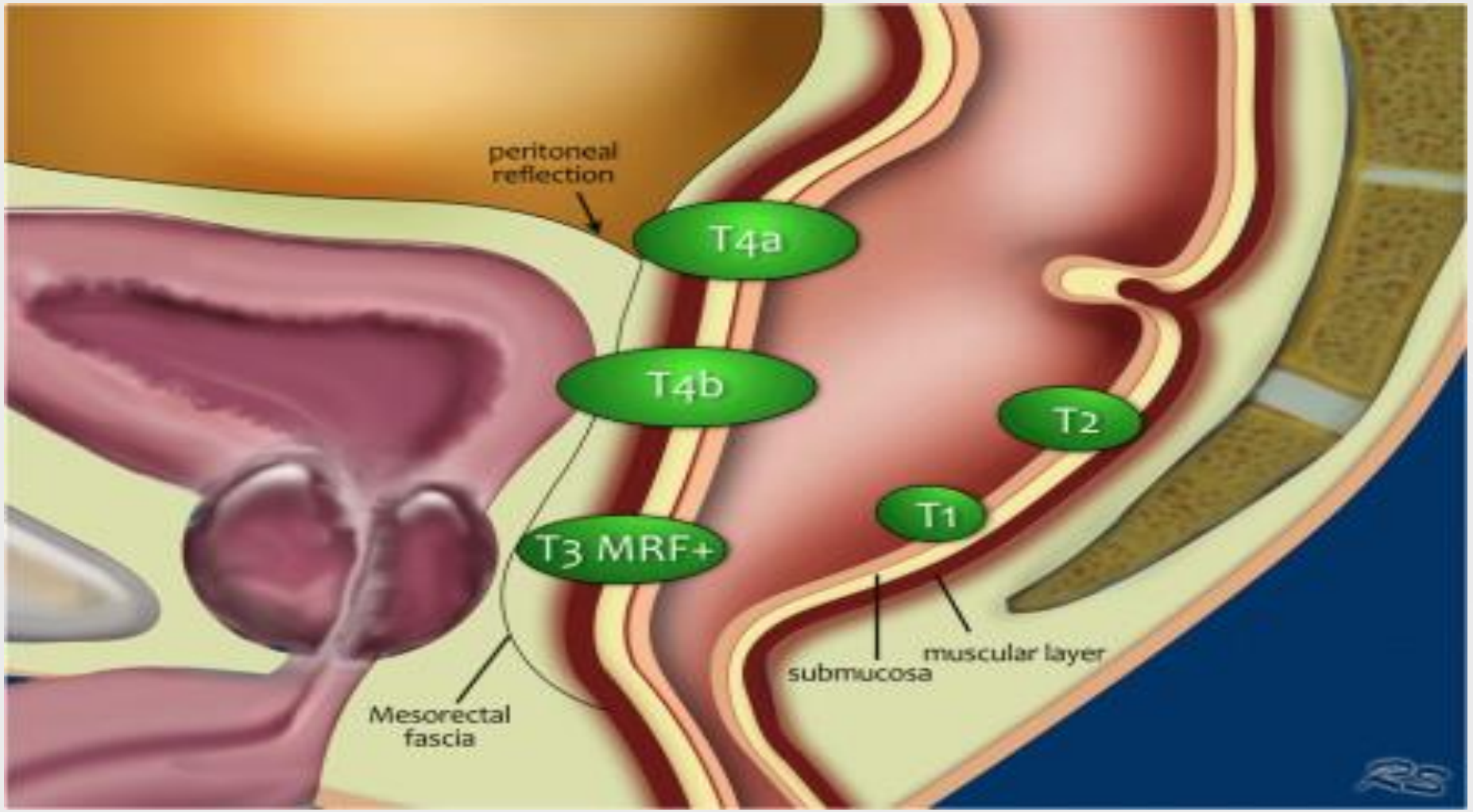
T-staging

T1 and T2 tumors are limited to the bowel wall.

T3 tumors grow through the bowel wall and infiltrate the mesorectal fat.

•T3 MRF+ tumor within 1mm of MRF
MRF- no tumor within 1 mm of MRF




peritoneal reflection
T4a
T4b
T2
T1
T3 MRF+
submucosa
muscular layer
Mesorectal fascia

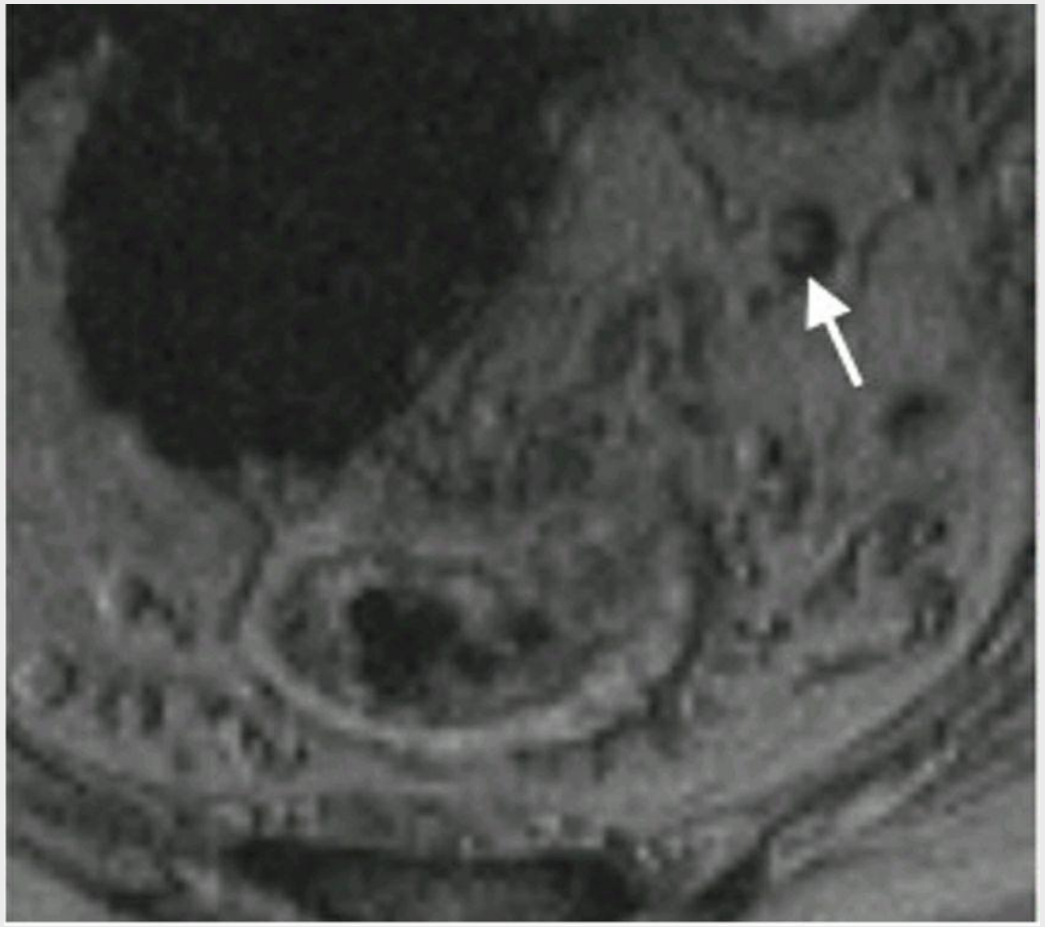
MR has proven to have a low diagnostic accuracy for distinguishing positive or negative lymph nodes when characterization is based on size criteria alone.

Some studies use a combination of both size and morphologic criteria.

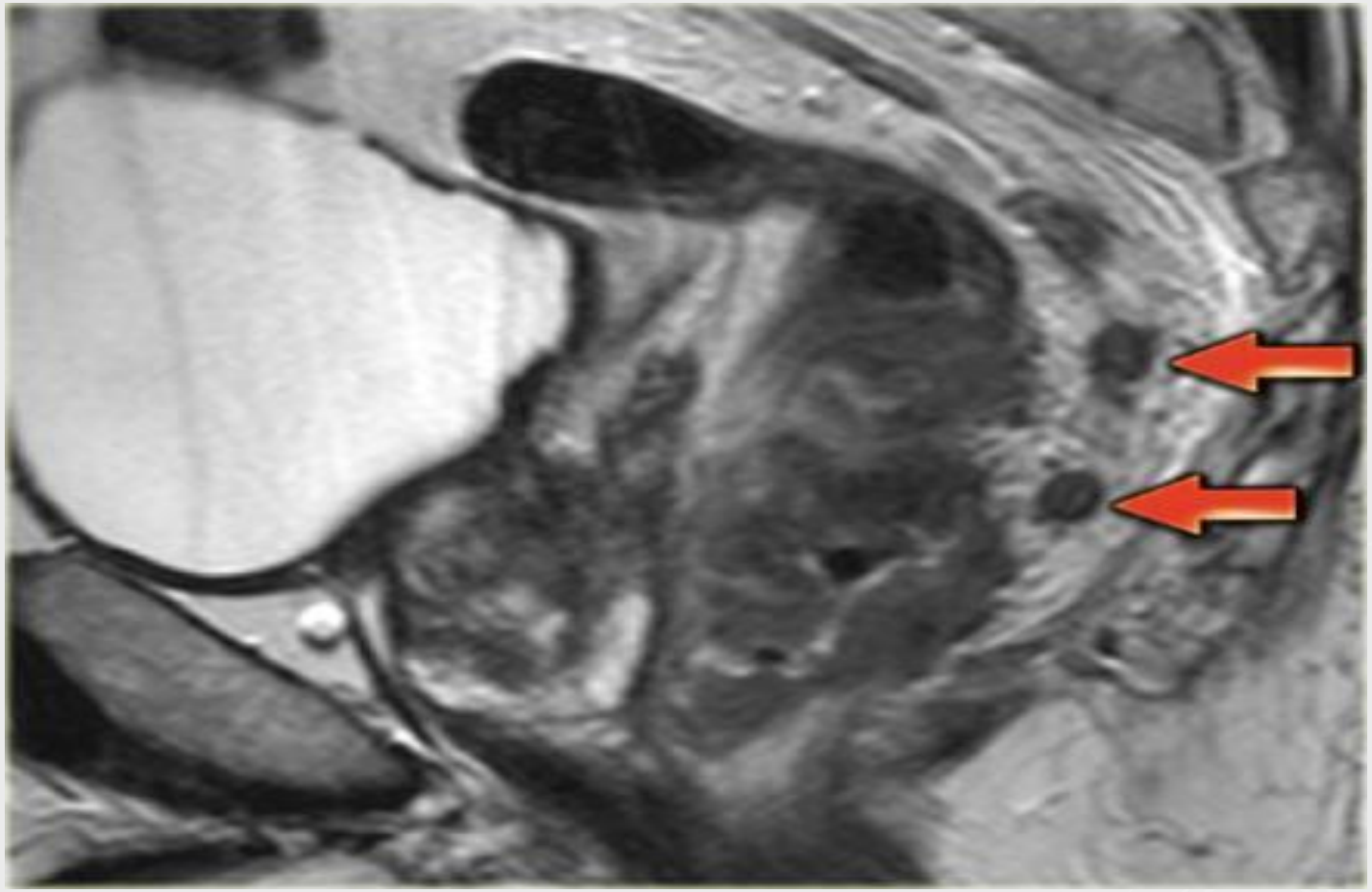
Nodes larger than 9 mm are always regarded as suspicious.

N-stage - suspicious nodes

Malignant characteristics	Indistinct  Heterogeneous  Round 
Short axis	· < 5mm : needs 3 malignant characteristics · 5 -9mm : needs 2 malignant characteristic · > 9mm : always suspicious
cN-stage	· N0 : **no** *suspicious* lymph nodes · N1 : 1-3 *suspicious* lymph nodes · N2 : ≥ 4 *suspicious* lymph nodes



A pathologic left mesorectal node, with focus of eccentric nodal hyperintensity (arrow).



Sagittal T2W : Low rectal cancer with multiple nodes in the mesorectal fat on the posterior side.
Some of the nodes on this image are heterogenous and have irregular borders.
There were more than 4 suspicious nodes in this patient (N2-stage).

Regional lymph nodes

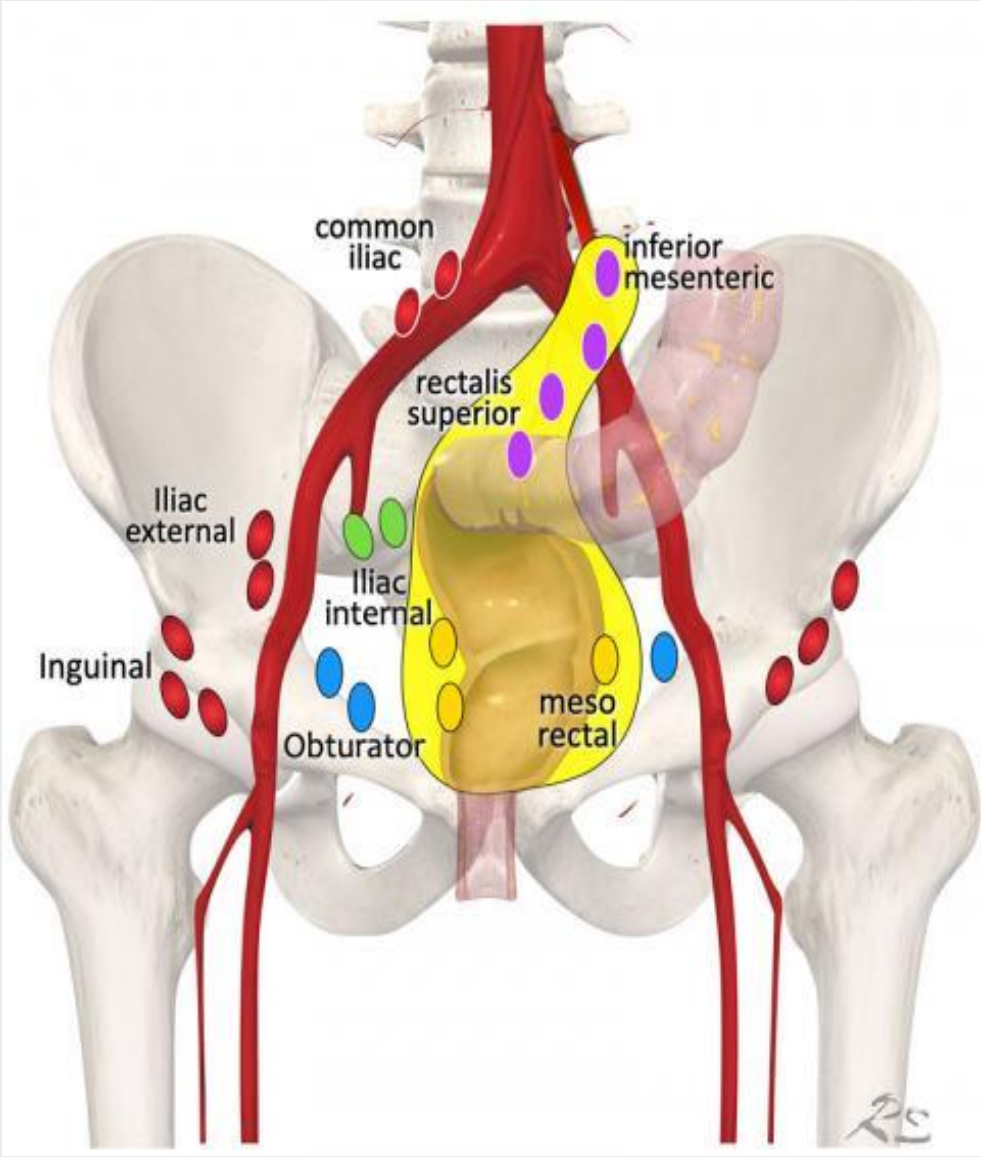
include all nodes that are part of the N-stage:

- Mesorectal lymph nodes (yellow).
- Nodes in the mesocolon of the distal sigmoid, along the "presacral" inferior mesenteric and rectalis superior blood vessels (purple)
- Nodes in the obturator spaces (blue)
- Nodes in the internal iliac spaces (green)

Non-regional lymph nodes (all in red)
include all nodes that – when involved – are considered distant nodal metastases and are therefore part of the M-stage:

External iliac nodes
Common iliac nodes
Inguinal nodes

N.B: As an exception to this rule is to consider inguinal nodes as regional nodes in case of low rectal tumors extending into the distal anal canal, below the level of the dentate line.

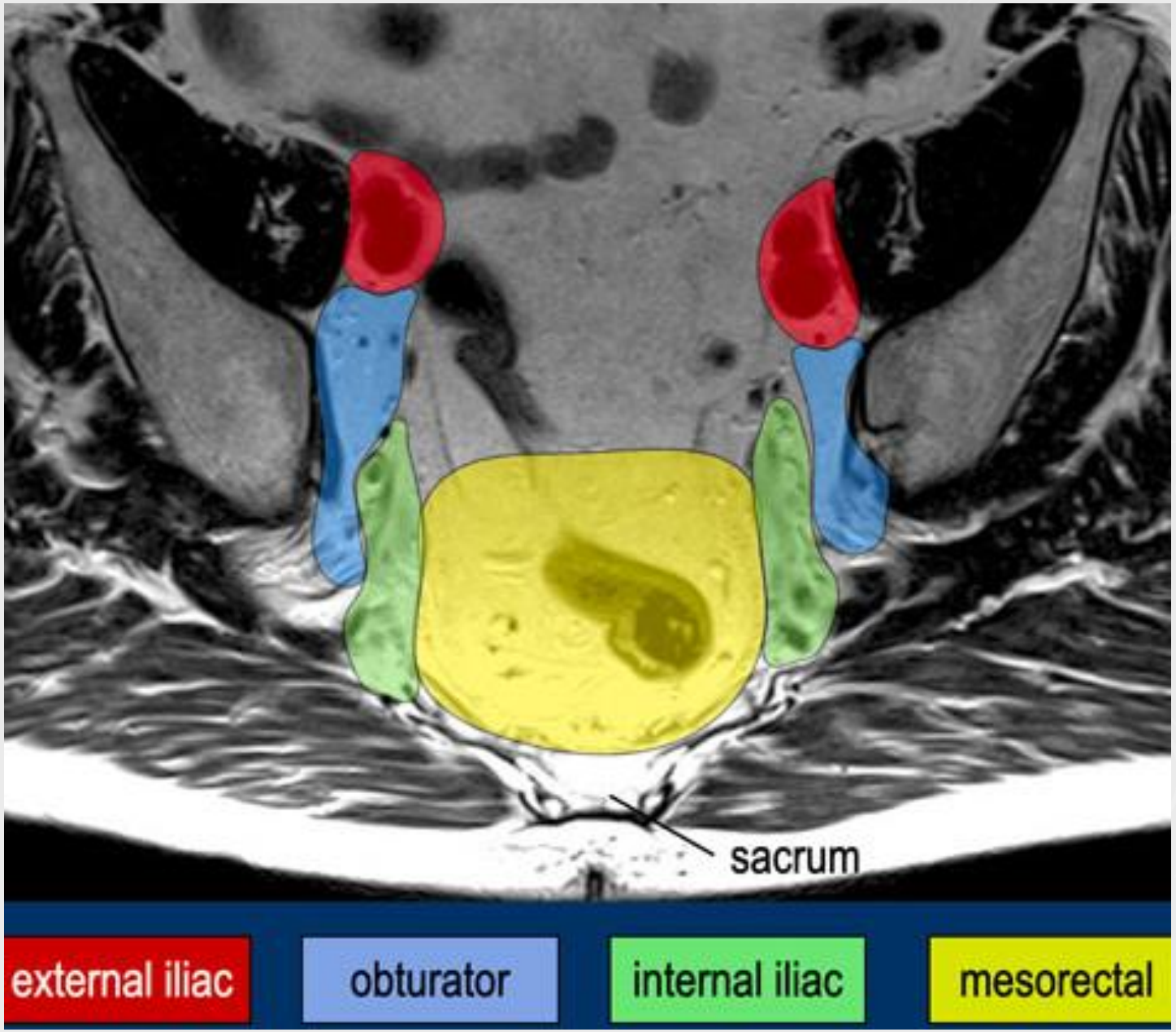


NOTE THAT

The obturator and internal iliac spaces are divided by

the lateral border of the main trunk of the internal iliac vessels.

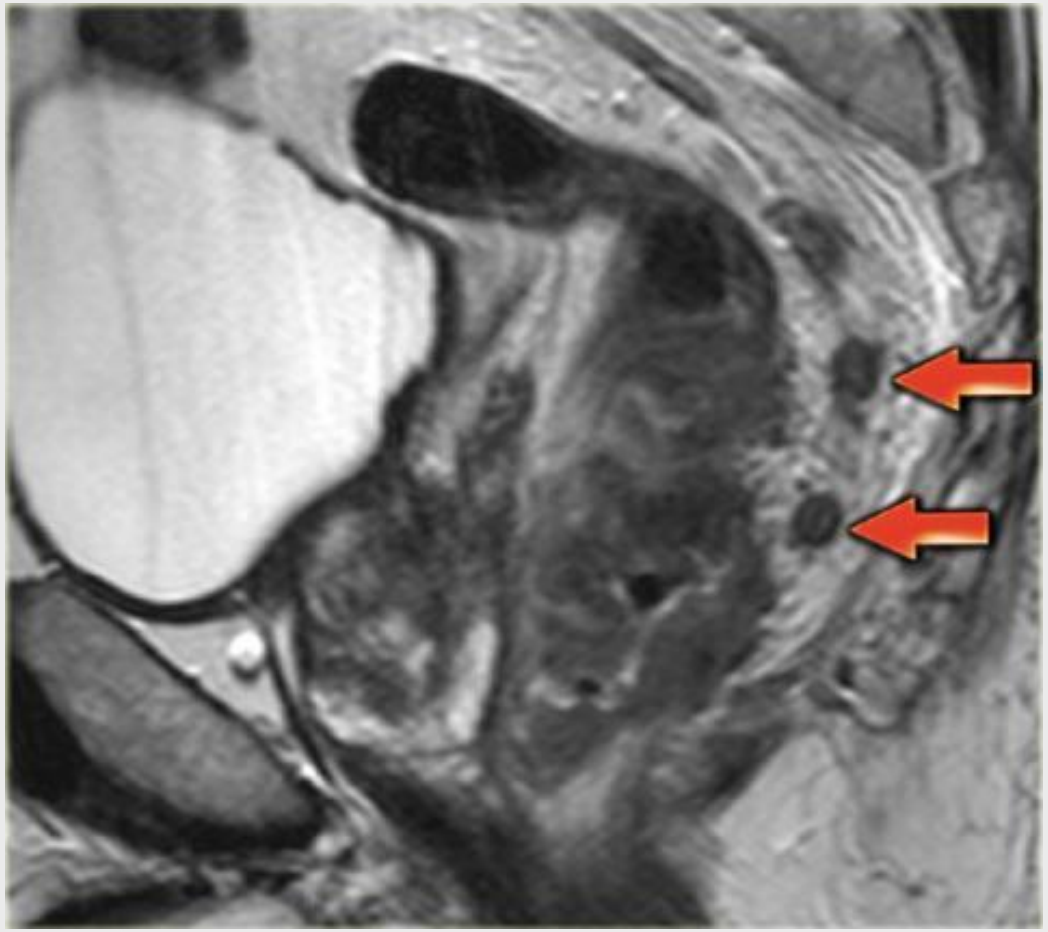
The posterior border of the external iliac compartment is defined by the posterior border of the external iliac vessels



Internal iliac and obturator L.Ns are called the lateral L.Ns or extramesorectal L.Ns

Criteria for Lateral lymph nodes	
Suspicious if	≥ 7 mm (obturator & internal iliac)
	Size criteria only
	Any morphology

Update…

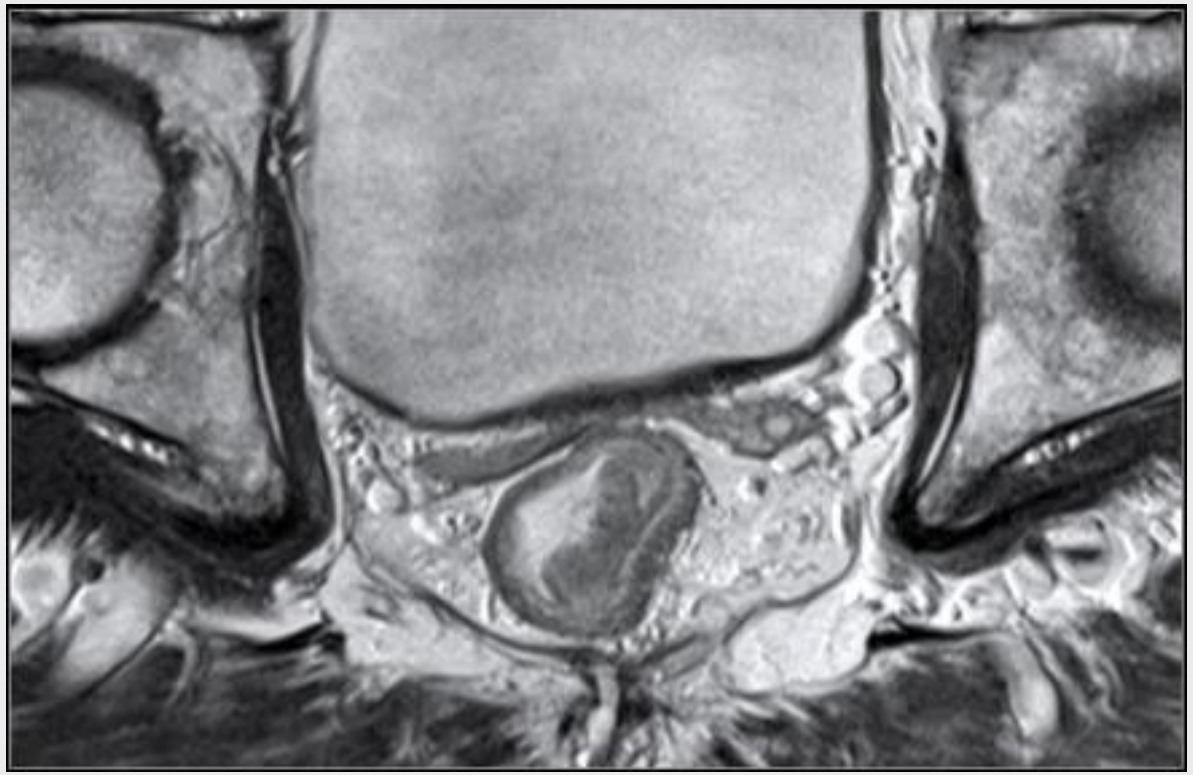


Pathologic L.Ns and tumor deposits can look very similar on imaging and there are no widely adopted criteria to discriminate the two.

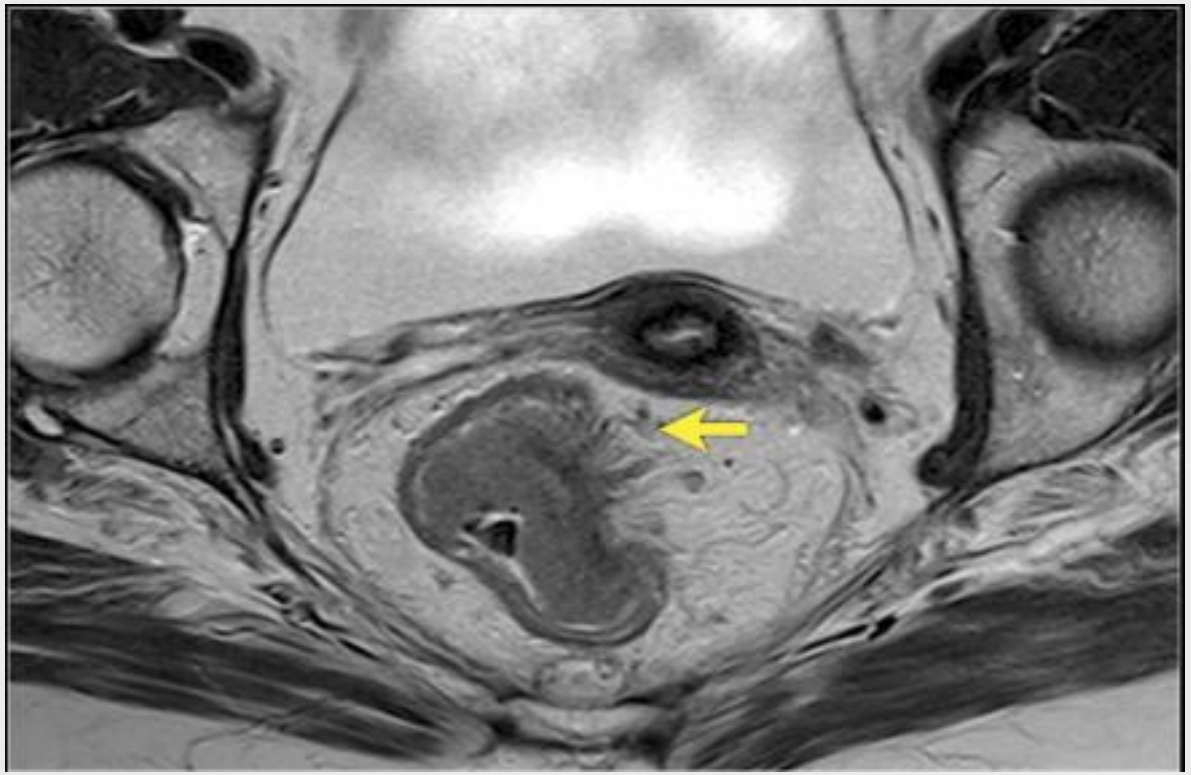
The 2021 TNM staging advised to group nodes and deposits together in the cN-stage.

M-stage of Rectal Cancer

M0	No metastases
M1a	Metastases to one organ without peritoneal metastases (N.B. metastases in a bilateral paired organ, e.g. both lungs, both kidneys, or both ovaries is still M1a)
M1b	Metastases to two or more organs
M1c	Peritoneal metastases with or without organ metastases



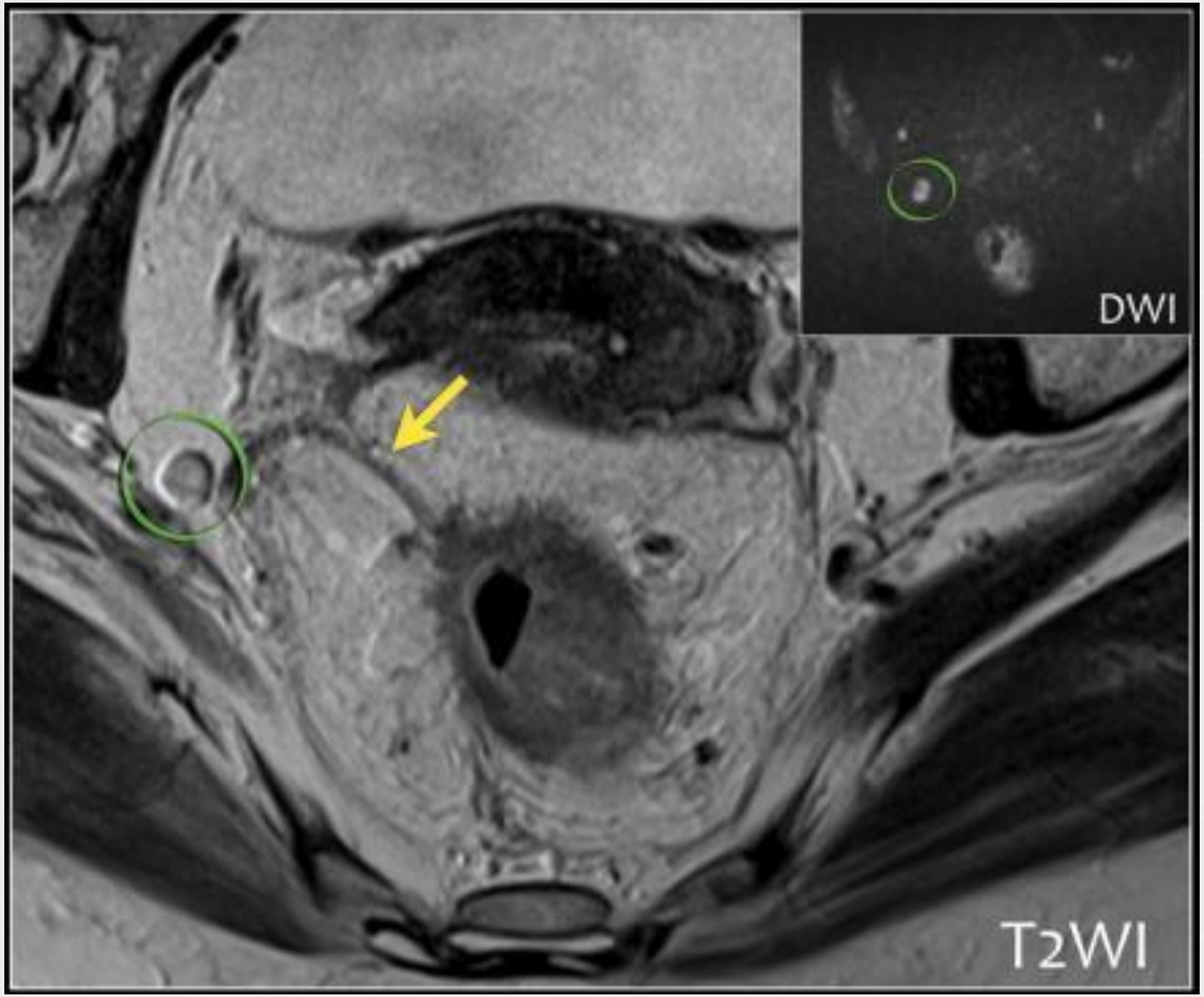
semicircular T2 tumor in the distal rectum, with sharply demarcation of the external muscular layer.



T3 MRF- rectal cancer. Semicircular mid rectum tumor with tumor invasion into the mesorectum, extending from 1-4 o'clock of the circumference.

It is important to look beyond the mesorectum for lymph nodes.

These **extramesorectal nodes** are important, because they can be a cause of local recurrence,

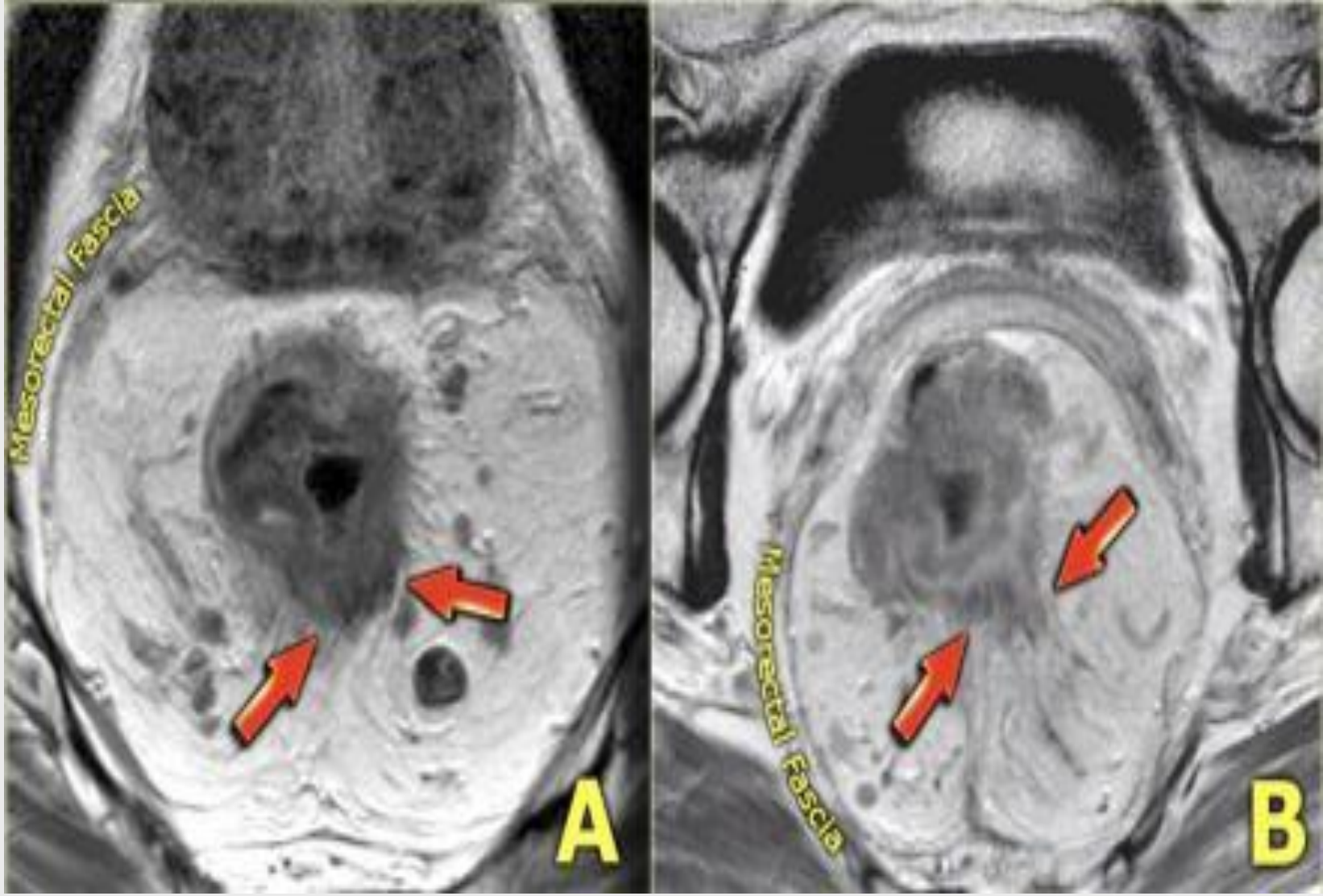


The image shows a circular T3 tumor with extramural vascular invasion (EMVI), bridging to the right extramesorectal space (yellow arrow).
In addition there is a suspicious extramesorectal lymph node (green circle).

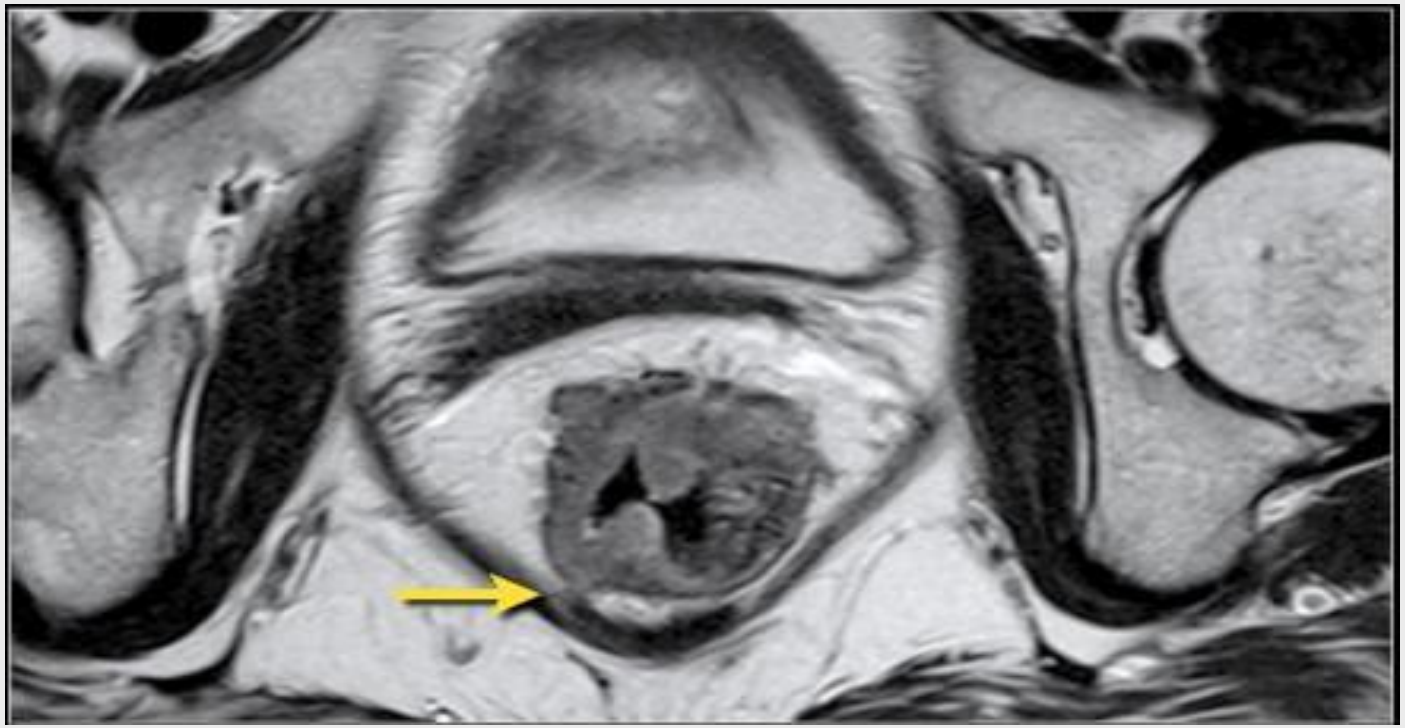
Perirectal stranding

Difficulty in distinguishing true mesorectal tumor invasion from desmoplastic reaction, is the main cause of over-staging.

To prevent understaging, it is recommended to stage a tumor as T3 when stranding is present.



**Here we see two tumors with a similar MR-appearance.
In A there was perirectal tumor invasion.
In B the tumor was limited to the bowel wall, i.e. a T2-tumor.
The perirectal stranding in the latter case was the result of a desmoplastic reaction.**



The image shows a tumor that infiltrates the mesorectal fat with involvement of the resection margin on the posterior side (arrow).
This tumor is classified as **T3 MRF+.**

- **Description of suspicious nodes should be subdivided into mesorectal - and extramesorectal nodes, as location of the nodes may influence radiation planning and surgical excision.**

Rectal cancer MR-report	
Morphology	Polyp - Solid tumor - Mucinous tumor
Length	Measure in cm
Level	Distance from anorectal junction to lower border of tumor - low rectum : 0-5cm - mid rectum : 5-10cm - high rectum : 10-15cm
Location	Circumference : ... - ...o'clock or description
cT-stage	T1 or T2 : limited to bowel wall T3a : <1 mm beyond muscularis propria T3b : 1-5 mm T3c : 5-15 mm T3d : > 15 mm T4a : involvement peritoneal reflection T4b : ingrowth in organ
MRF	Shortest distance to mesorectal fascia - MRF involved : distance ≤ 1mm - MRF not involved : distance > 1mm
cN-stage	N0 : ***no*** *suspicious* lymph nodes N1 : 1-3 *suspicious* lymph nodes N2 : ≥ 4 *suspicious* lymph nodes

The End