

XXIII CONGRESSO  
**AIRO2013**

Giardini Naxos - Taormina, 26-29 ottobre

Regione Siciliana - Assessorato Regionale dei Beni Culturali e dell'Identità Siciliana  
Dipartimento dei Beni Culturali e dell'Identità Siciliana  
Servizio Museo Interdisciplinare Regionale "A. Papoli" Trapani.



# Il Carcinoma Anale

## Imaging morfo-funzionale nella valutazione della risposta



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In the management of patients with anal cancer, CCRT response is the most important tool in predicting tumor recurrence and patient survival rate.

There are no clinically supported prediction methods for CCRT response in patients with rectal cancer.



Only measurement of tumor size and volume with imaging is useful in verifying treatment response

## FOLLOW UP POST CHT-RTH

### Requisiti ideale delle metodiche di imaging

Anatomia zonale

Ampio campo di vista

Alta risoluzione spaziale

Risoluzione di contrasto

Imaging tridimensionale

Imaging quantitativo

Imaging funzionale (angiogenesi, diffusione, molecolare)

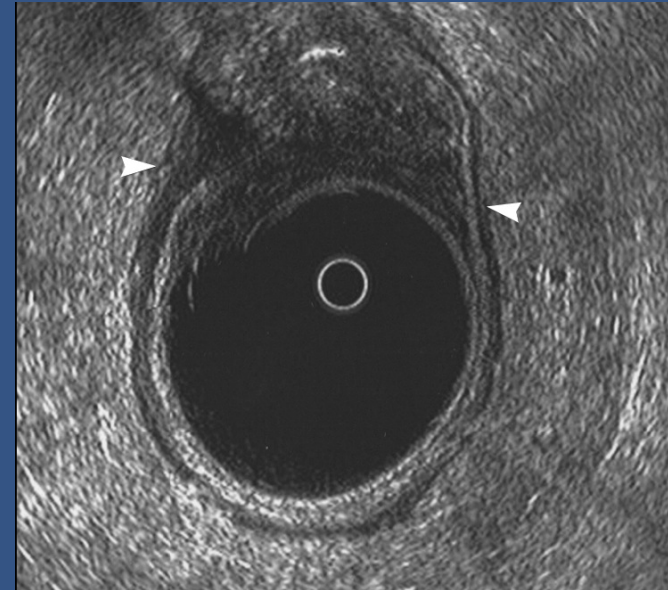


US - CT - RM

# Ecografia transanale

Individua gli strati della parete intestinale

Accuratezza nel definire la profondità d' invasione



Pre trattamento 66-95%

Post 53-59 %

## Limiti

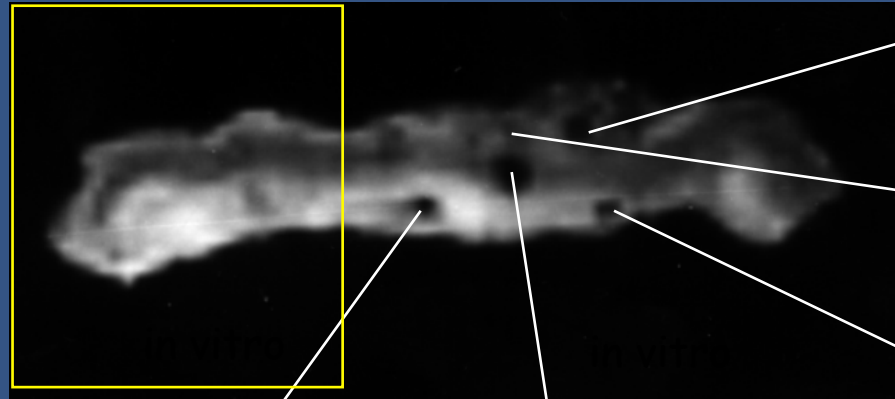
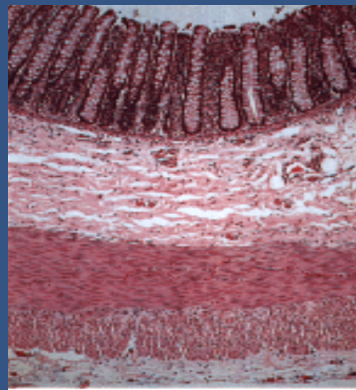
Lesioni o stenosanti  
FOV limitato  
scarsa accuratezza nella valutazione dei linfonodi  
difficile escarsa esperienza mdc

Blomqvist L. MR imaging using pelvic phased array and endorectal colis vs endoscopic US. Eur radiol 2000;10:653-660

Fuchsjager H. Comparison of transrectal US and double-Contrast MR imaging when staging rectal cancer. AJR Aug 2003;181:421-426

# Anal Carcinoma

## MRI : ZONAL ANATOMY



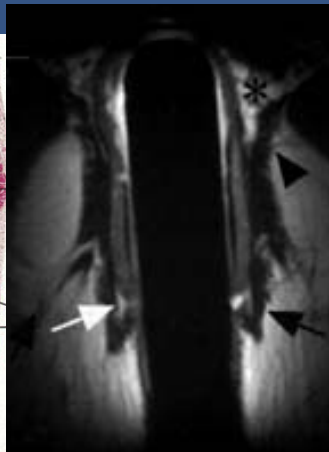
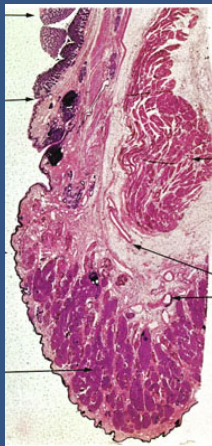
mucosas

submucosas

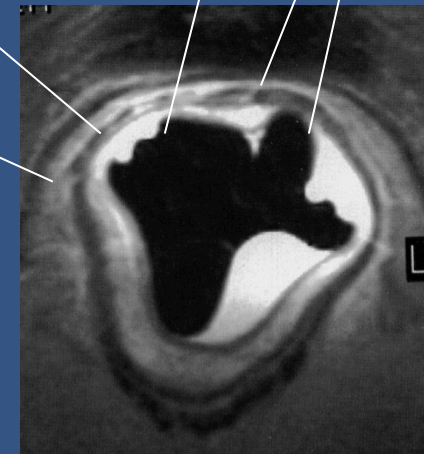
sierosa

Fat tissue

muscle



Anus and  
rectal-anal junction



T staging - accuracy 71% - 91%

# Anal Carcinoma

## Background

**MRI with external pelvic phased array coil is considered the gold-standard for the study of anal cancer**

High-resolution images of zonal anatomy (layers of canal wall)

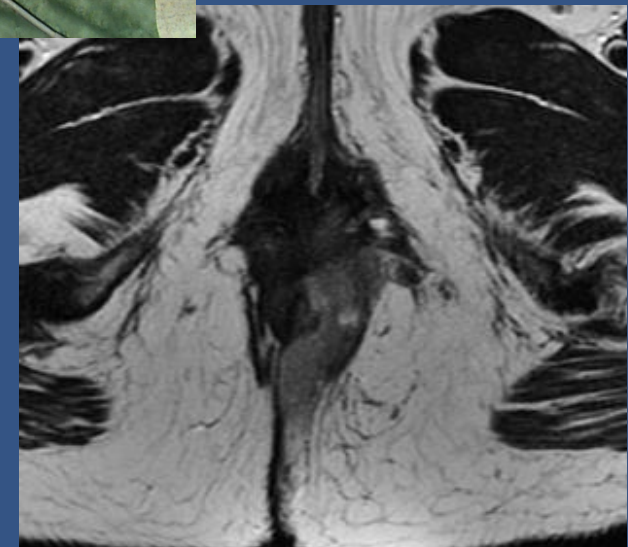
Wide field of view

Multiplanar images

No patient's discomfort



Phased array



Roach SC, Hulse PA, Moulding FJ, Wilson R, Carrington BM. Magnetic resonance imaging of anal cancer. Clin Radiol 2005;60:1111-19.

CCRT



Goal of imaging

Down staging (T3 T2),



Down size

- Miglioramento della resecabilità
- Preservazione dell'attività sfinteriale
- Controllo locale
- Miglioramento della sopravvivenza
- Riduzione tasso di recidiva

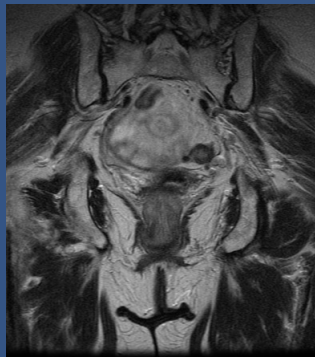
Sauer R. preoperative vs postoperative chemoradiotherapy for rectal cancer  
N Engl J med 2004:351-1731

Recering A. favourable pathological stage after neoadjuvant chemoradiotherapy in patients with irresectable rectal cancer  
Correlates with a favourable prognosis Eur J Cancer 2003: 39-195

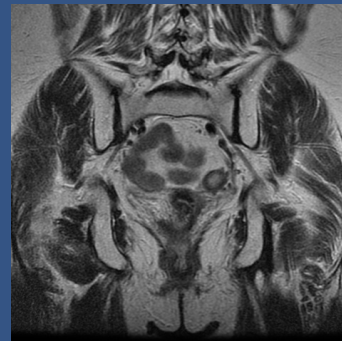
# Anal Carcinoma

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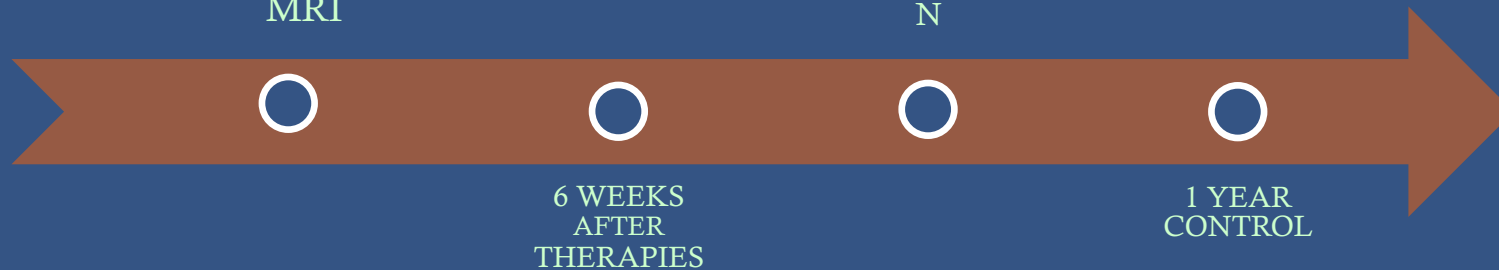
clinical assessment is routinely performed 6 weeks after completion of chemoradiotherapy. The first follow-up MRI study should be performed 24 weeks (6 months) after chemoradiotherapy.



PRE-  
CHEMORADIATION  
MRI



6 MONTHS AFTER  
CHEMORADIATIO  
N

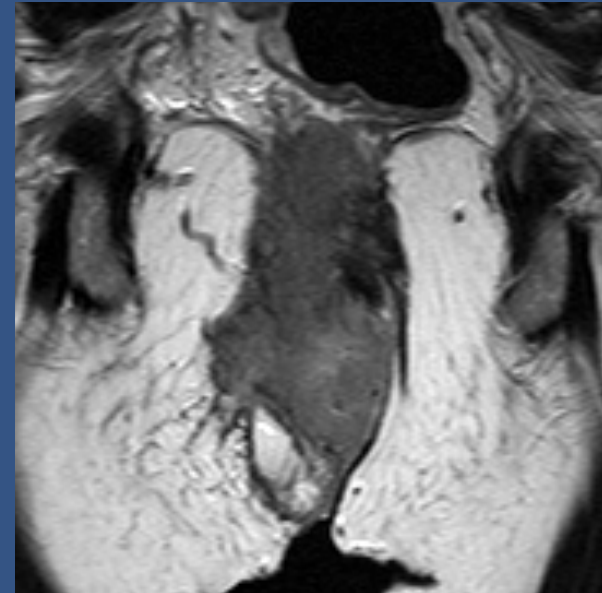
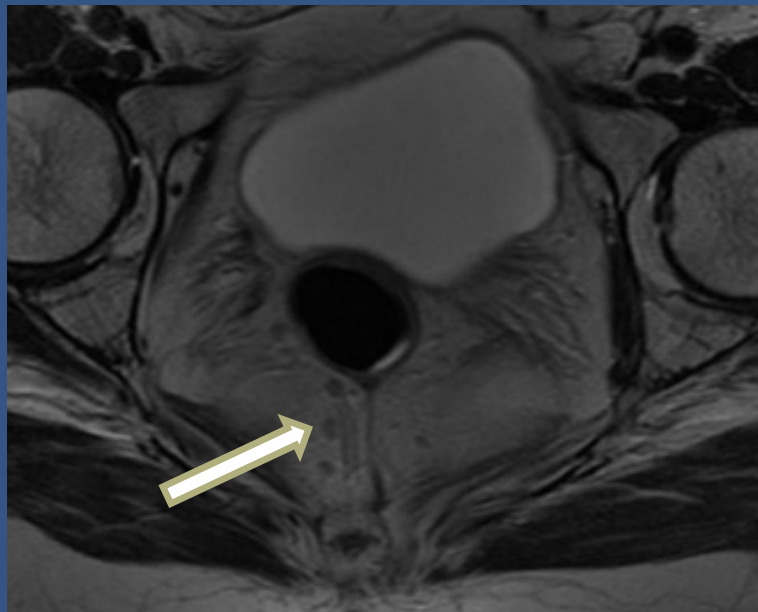




# Anal Carcinoma

## Diagnostic Criteria pre-CCRT- MR

- Circonfferenziale
- Stenosante
- Invasione piano perineale
- Interessamento linfonodale



Soft-tissue infiltration

Lymph node  
spiculated/indistinct margins

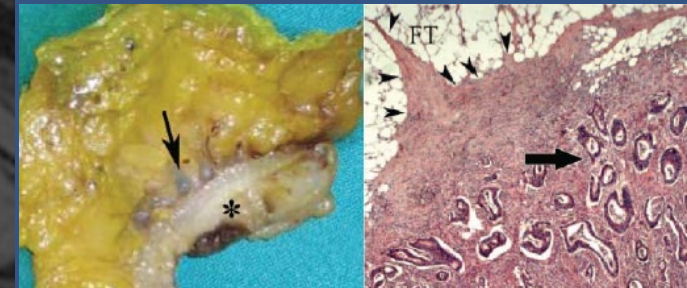
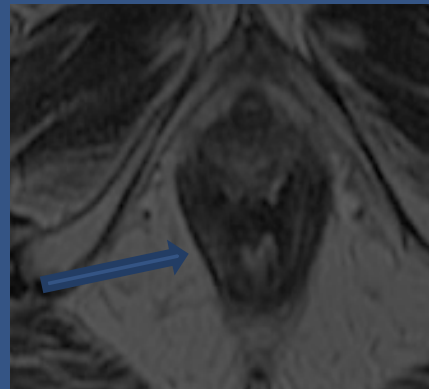
mottled or heterogeneous signal  
intensity

# Anal Carcinoma

# Diagnostic Criteria

In the post-CCRT period, the application of diagnostic criteria for pre-CCRT imaging results in lower accuracy.

- fibrosi residua
- raccolte di mucina
- aree necrotiche
- reazione infiammatoria

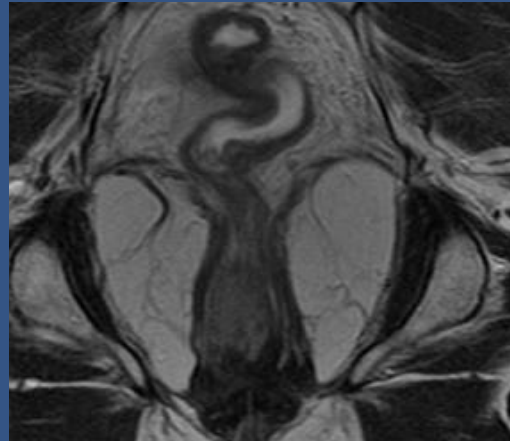
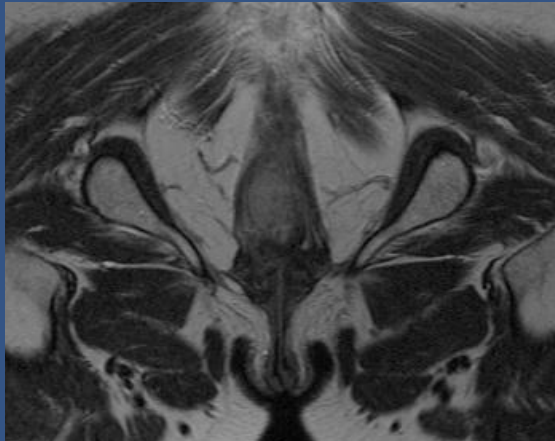


Tissue Changes at MR Imaging	Histologic Finding	
	Tumor Invasion	No Tumor Invasion
Pattern A: fat pad > 2 mm	0	4
Pattern B: spiculations	0	22
Pattern C: diffuse hypointense "fibrotic" infiltration	21	32
Pattern D: diffuse iso- or hyperintense infiltration	19	2

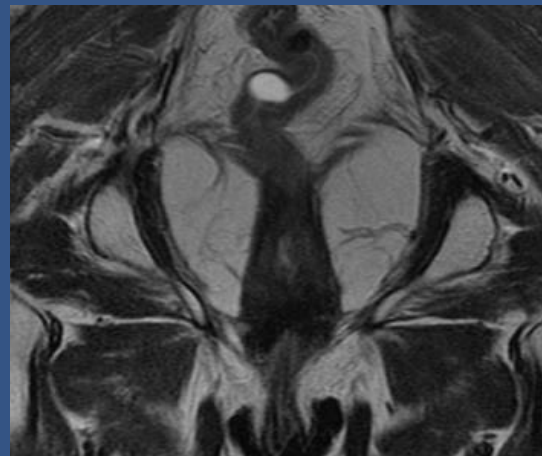
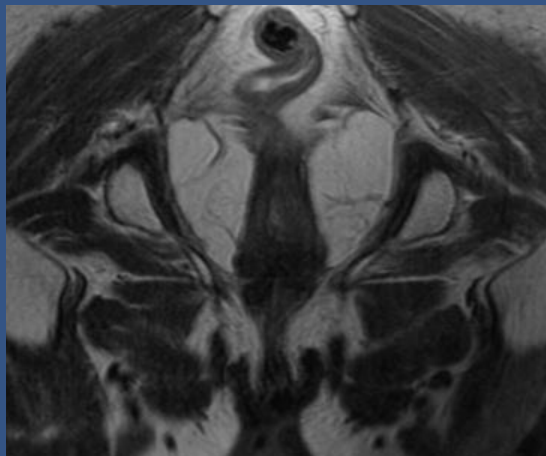
# Anal Carcinoma

# Pattern B

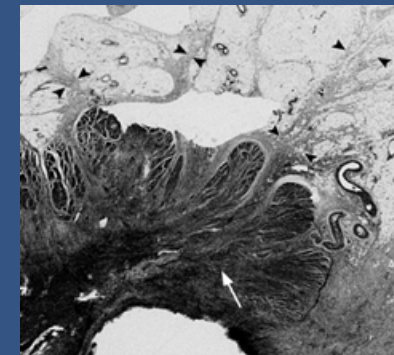
62 year-old woman with anal cancer. MR images performed before therapies show T2 hyperintense anal tumor that involves right levator ani muscle.



Post chemo-radiation  
Spiculations remain  
unchanged



6 WEEKS AFTER CCRT

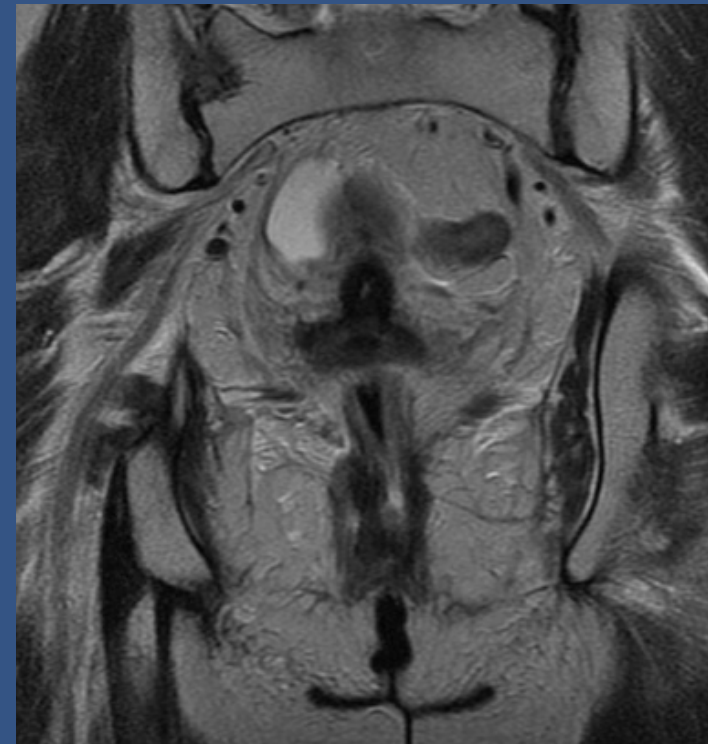
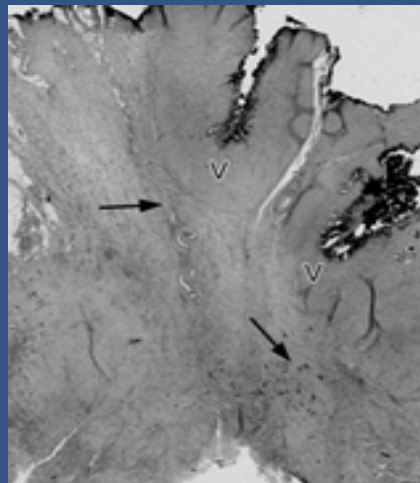
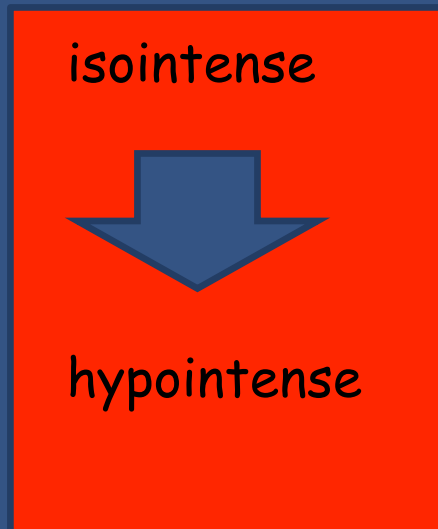


tumor has diminished in size  
and has become hypo-intense  
signal

# Anal Carcinoma

# Pattern C

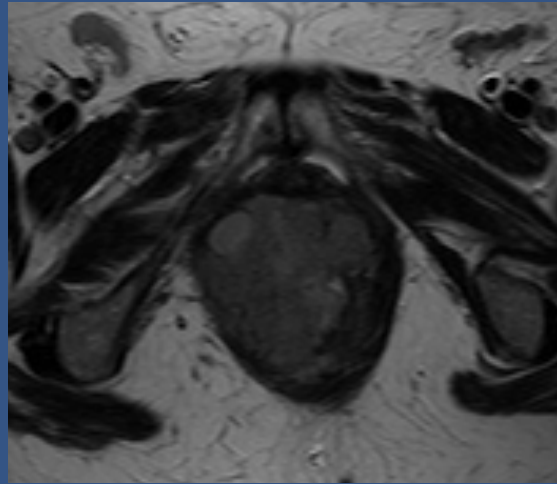
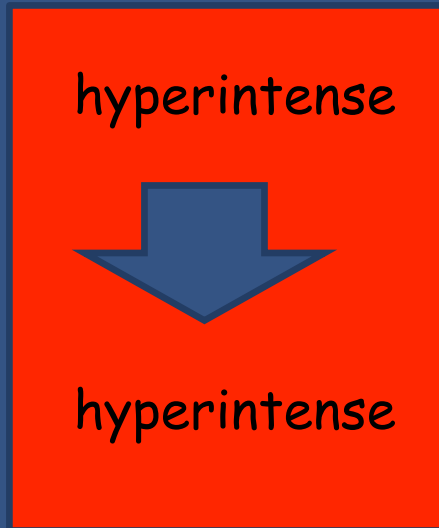
Diffuse hypointense tissue infiltration



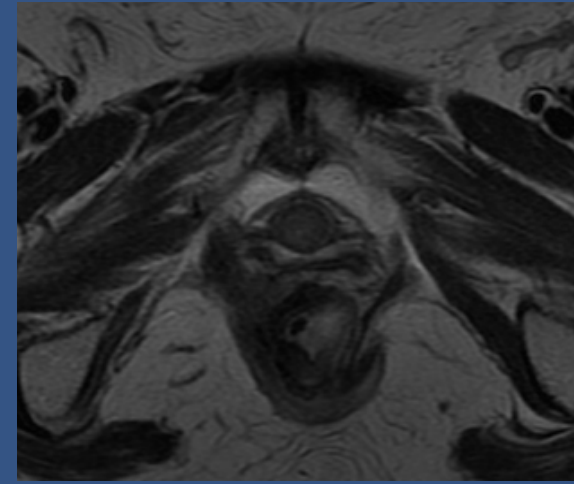
# Anal Carcinoma

# Pattern D

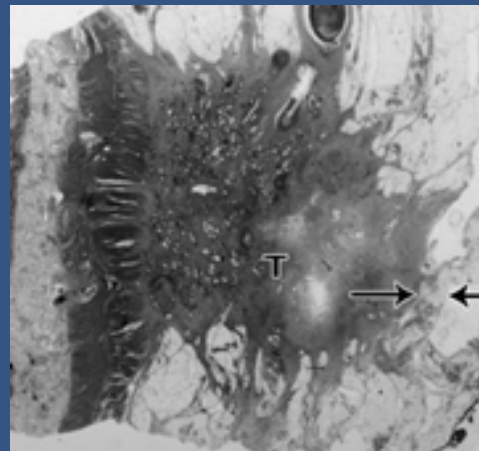
Diffuse hyperintense tissue infiltration



Pre.treatment



2 weeks post-CCRT



62 year-old woman with anal cancer. MR images performed before therapies show T2 hyperintense anal tumor that involves right levator ani muscle.

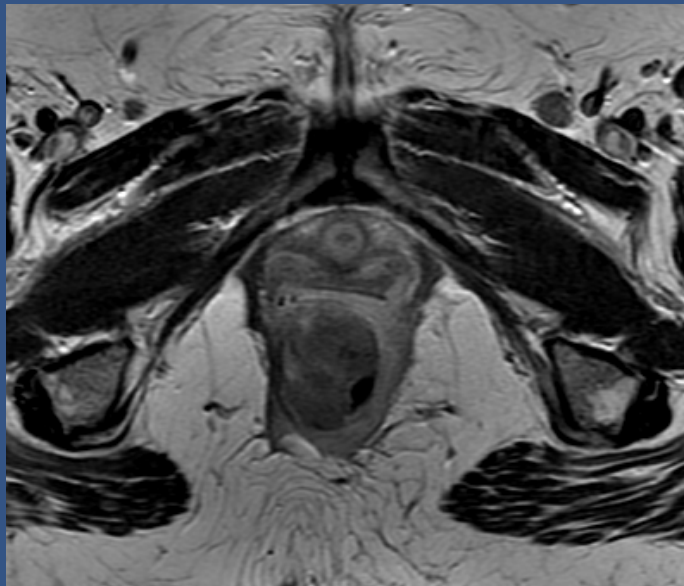
# Anal Carcinoma

# Pattern D

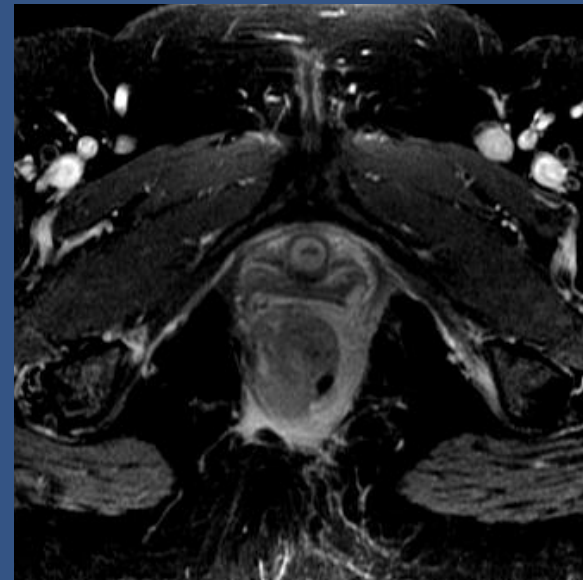
Diffuse hyperintense tissue infiltration



Use of Dynamic CE MR



PRE-MDC T1-W



POST-MDC T1-W FAT-SAT

# Anal Carcinoma

## down staging

Il volume pretrattamento non correla col down staging  
( $p=0,11$ ),

Il volume post trattamento e la percentuale di riduzione sono  
significativamente differenti tra pz con e quelli senza down  
staging

Table 2. Summary of tumor volumes before and after chemoradiation and % volume reduction rates for patients with pathologic confirmation of a down-staging and those with no response to chemoradiation

	Downstaging	Non-response	All patients	<i>p</i> Value
Total	57 (50.9%)	55 (49.1%)	112	
Pretreatment volume				
<15 cc	34 (59.6%)	24 (43.6%)	58 (51.8%)	
≥15 cc	23 (40.4%)	31 (56.4%)	54 (48.2%)	0.11
Posttreatment volume				
<5 cc	41 (71.9%)	26 (47.3%)	67 (59.8%)	
≥5 cc	16 (28.1%)	29 (52.7%)	45 (40.2%)	0.01
% volume reduction rate				
<70%	19 (33.3%)	30 (54.5%)	49 (43.8%)	
≥70%	38 (66.7%)	25 (45.5%)	63 (56.2%)	0.047

Table 3. Summary of tumor volumes before and after chemoradiation and % volume reduction rates for patients with pathologic confirmation of a complete regression and those with residual disease after chemoradiation

	Complete regression	Residual disease	All patients	<i>p</i> Value
Total Pretreatment volume	16 (14.3%)	96 (85.7%)	112	
<15 cc	8 (50%)	49 (51%)	57 (50.9%)	0.25
≥15 cc	8 (50%)	47 (49%)	55 (49.1%)	
Posttreatment volume				
<5 cc	10 (62%)	57 (59.4%)	67 (59.8%)	0.81
≥5 cc	6 (38%)	39 (40.6%)	45 (40.2%)	
% volume reduction rate				
<70%	6 (38%)	43 (44.8%)	49 (43.8%)	0.59
≥70 %	10 (62%)	53 (55.2%)	63 (56.2%)	

Volume tumorale pre e post trattamento e la % di riduzione della neoplasia non sono significativamente differenti tra i 2 gruppi (p=0,6)

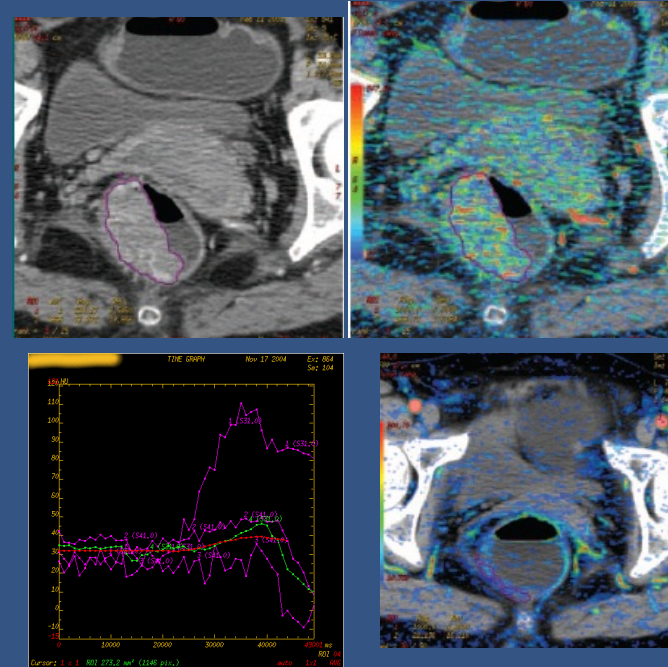


## PERFUSIONE TC/RM - PRINCIPI GENERALI

La perfusione TC/ RM fornisce informazioni sulla microcircolazione capillare dei tessuti

Lo scopo è quello di valutare e misurare il flusso ematico che irrorà l'organo esplorato espresso in ml / 100gr / min.

Questo flusso corrisponde alla perfusione sostenuta dal microcircolo tissutale piuttosto che dal flusso delle principali arterie.



### Parametri valutati

**TA**: time of arrival of the contrast agent in the slice after injection

**TTP** (Time To Peak): time corresponding to the maximum contrast variation

**MTT** (mean transit time) arterie

**PS** permeability surface

**Peak amplitude**: percentage increase/loss of the maximal signal

**rBV** (regional blood volume): index of blood volume determined by the area below the decreasing signal curve

**rBF** (regional blood flow): index of blood flow corresponding to the ratio  $rBV/MTT$ .

Evaluation of both the pre- and post-CCRT MR images is very important.

Comparing pre- and post-CCRT images, it is important to meticulously value such features as tumor extension, changes in tumor bulk and changes in tumor signal intensity.

Assessment soft tissue involvement by using tumor volume change or tumor signal intensity change during comparison of the pre- and post-CCRT images can improve the accuracy of post-CCRT MR imaging

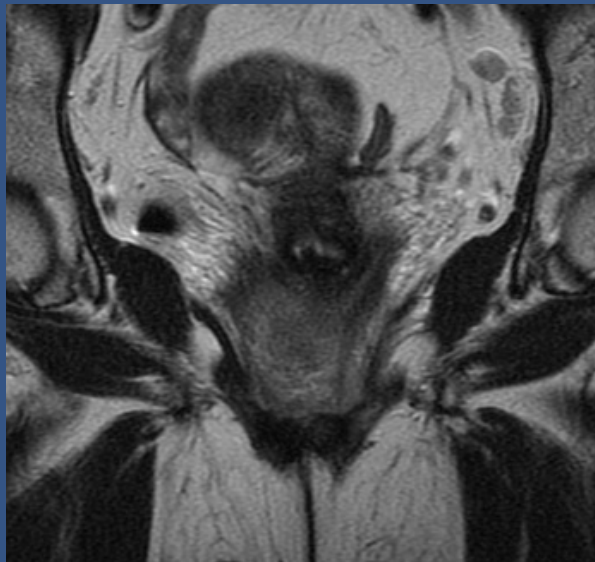
The low accuracy of MR imaging in predicting the pathologic stage of irradiated ano-rectal cancer appears to be related to both overstaging and understaging.

The major MR imaging finding that causes overstaging is diffuse hypointense tissue infiltration closed to the mass.

# Anal Carcinoma

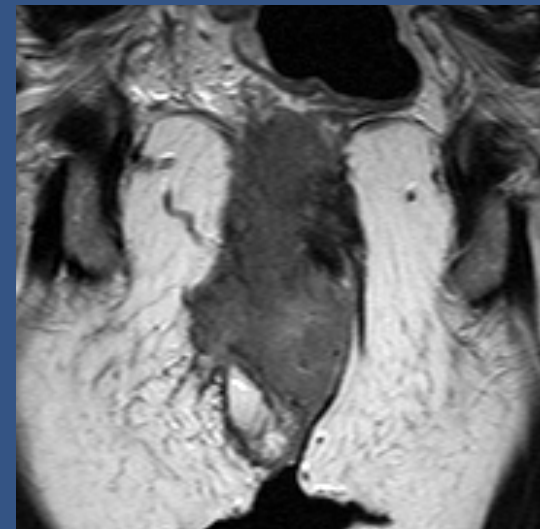
## Cause of overstaging

Most of the inaccuracy is associated with overstaging of pathologic stage T1 and T2 tumors .



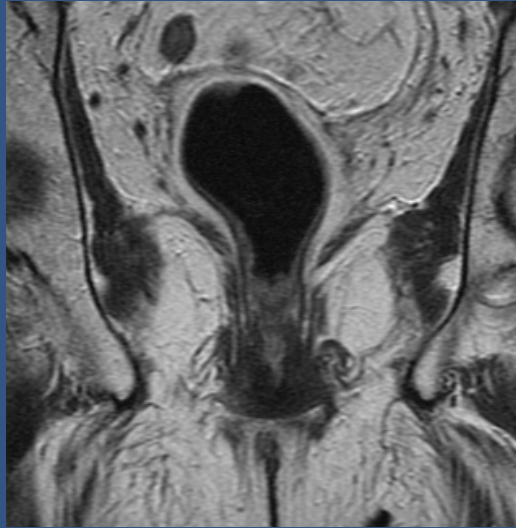
In addition, alteration of lymph nodes with or without metastasis after CCRT is assumed to be associated with metastasis, resulting in lymphnode overstaging.

Radiation proctitis or ulceration can sometimes cause overstaging



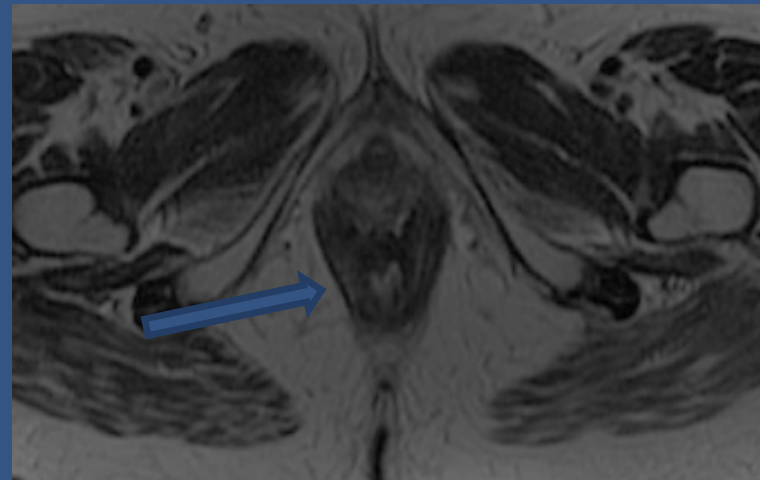
# Anal Carcinoma

## Cause of understaging



The major cause of understaging is nonvisualization of the tumor mass at MR imaging.

Alterations in the anal-rectum region after CCRT—such as histopathologic changes in the tumor, replacement by fibrotic scar tissue, and an island of residual carcinoma—make it difficult to detect feasible tumor on MR images

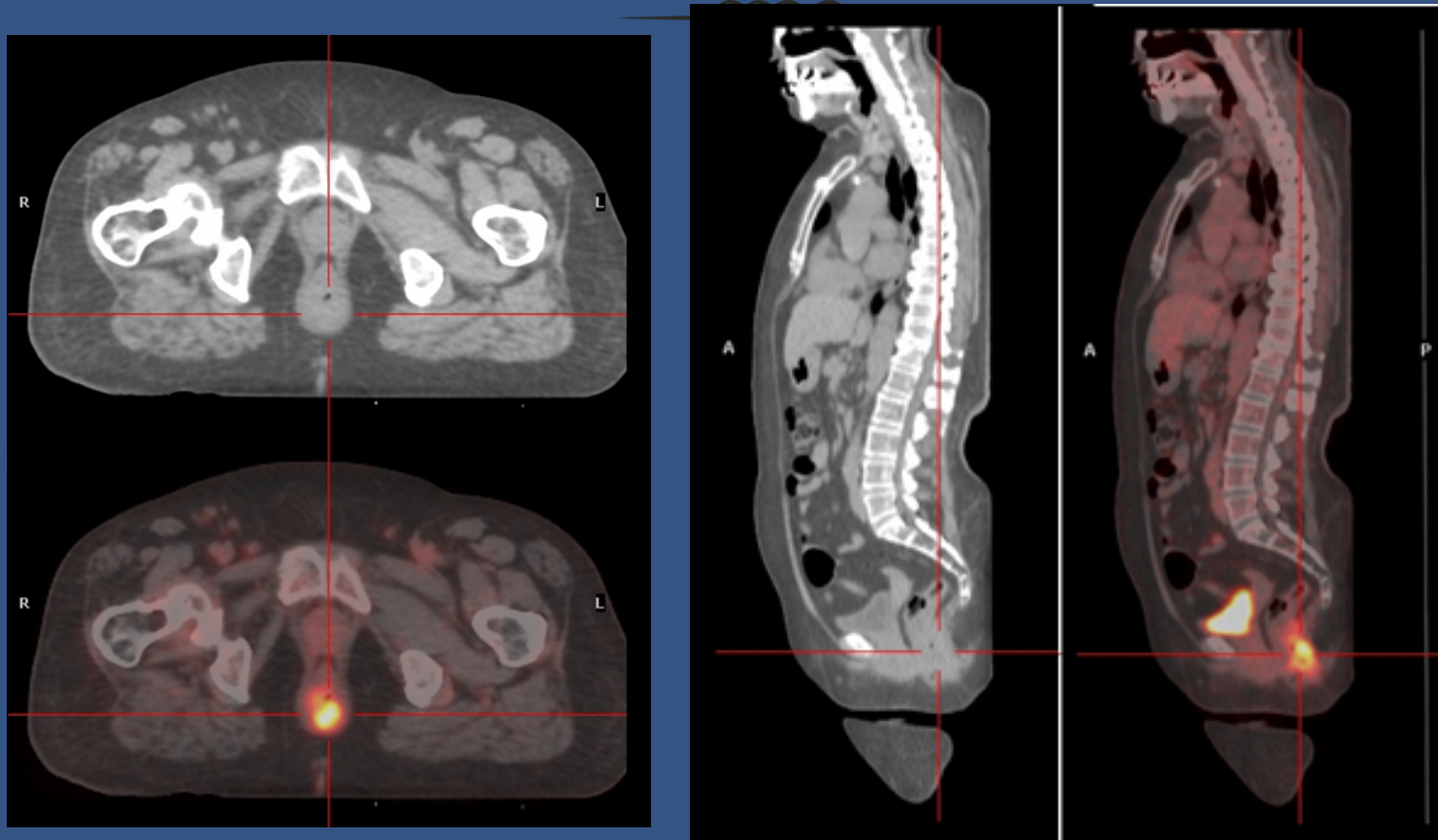


After CCRT, understaging with MR imaging is not a problem in cases where surgery is curative; however, it is a problem when a change in surgical strategy is being considered for some patients, especially those showing a complete tumor response.

# Anal Carcinoma

<sup>18</sup>F-FDG PET/CT

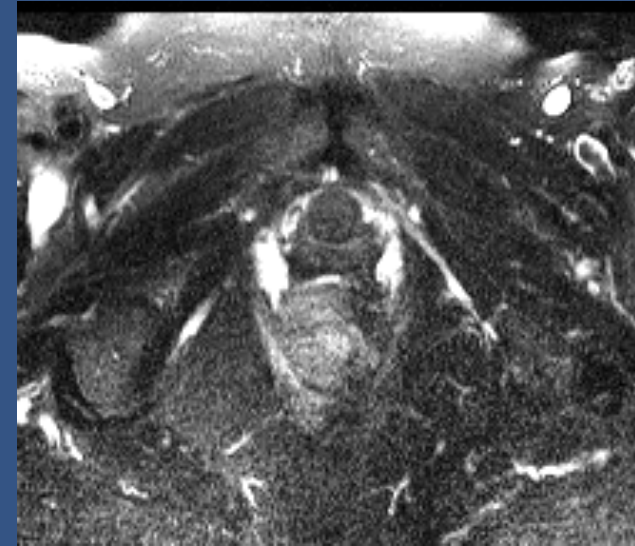
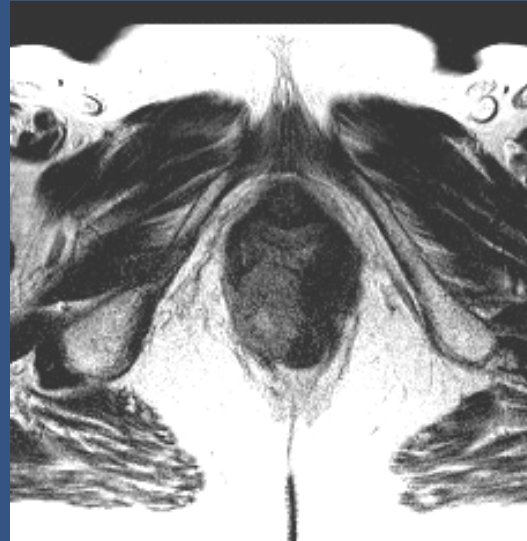
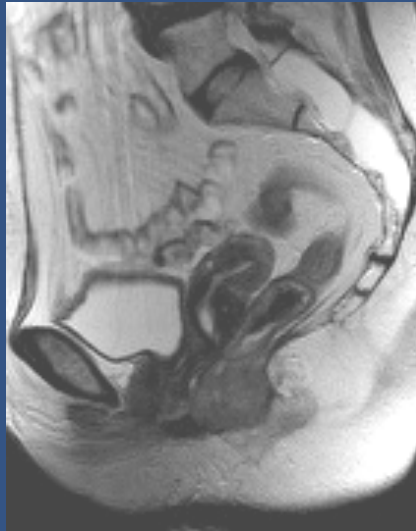
Assessing regional nodes and distant metastases



Grigsby PW. FDG-PET/CT: new horizons in anal cancer. *Gastroenterol Clin Biol* 2009; 33:456–458

# Anal Carcinoma

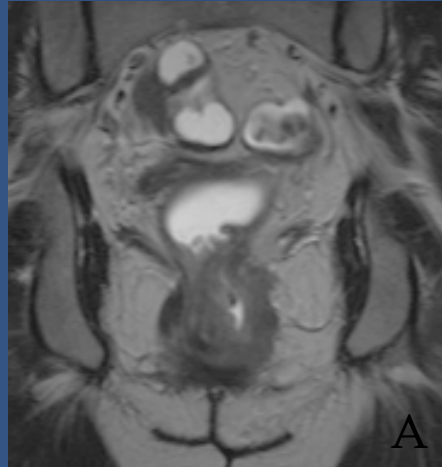
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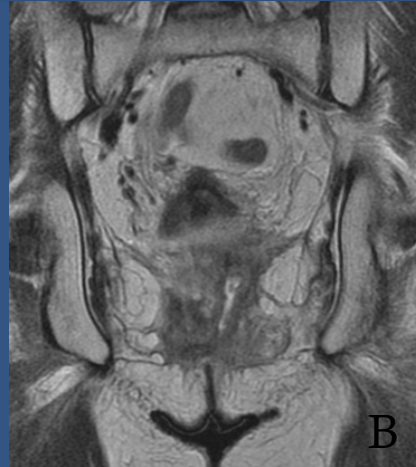
Locoregional and/or distant recurrence occurs in up to 35 % of treated patients, and is strongly associated with advanced (T3-T4) stage and nodal involvement at presentation.

# Anal Carcinoma

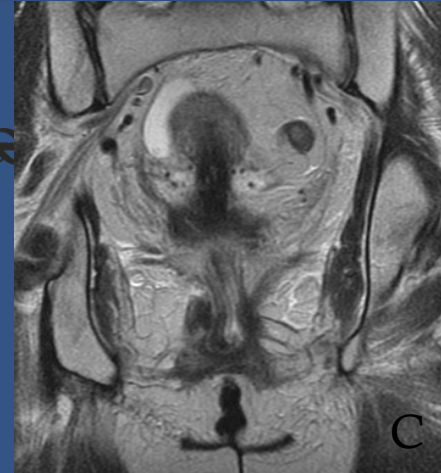
# Recurrence



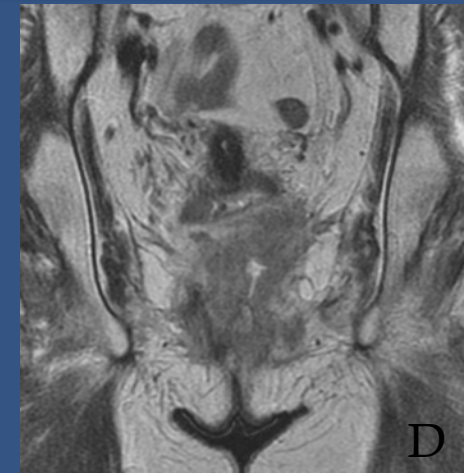
Before chemo-  
radiotherapy



During  
therapies



10 weeks after  
therapies



One year after  
control

40 year-old woman with anal cancer. A-B) Coronal T2-weighted MR images show T3 anal cancer that was treated with chemoradiotherapy. C) MR image obtained 10 weeks after therapies shows that tumor has diminished in size. There's also a loss of signal in tumor site. D) one year after control: the patient has shown recurrence with more advanced local disease .



The high contrast and anatomic resolution of pelvic MRI make it the best tool for locoregional staging and response assessment

Clear delineation of the anatomical boundaries of local disease enables optimal planning of radiation fields.

Following chemoradiation treatment MR would allow careful non-invasive monitoring of treatment response.

Appreciation of the range of post-treatment appearances can also aid in the early detection of disease relapse.