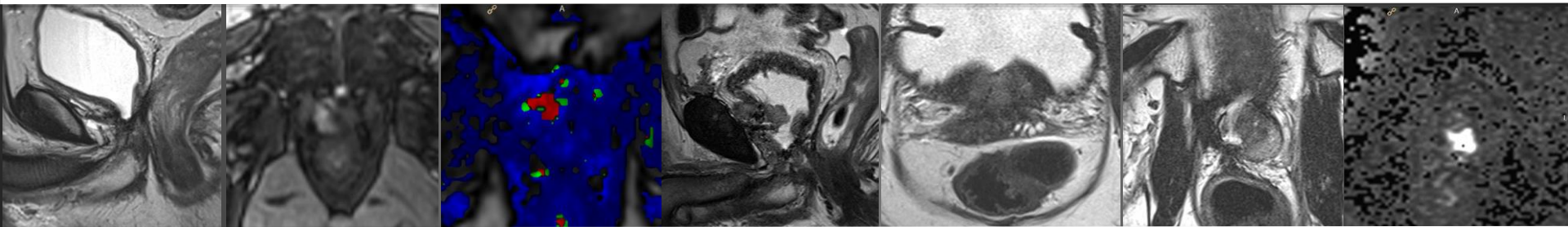


ACR Prostate MR course

Imaging of Prostate Cancer Recurrence with MRI



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Abdominal Imaging Section &
Nuclear Radiology Department

Disclosures

- Research support from Invivo Corp.

Objectives

1. Discuss the utility of MRI in the evaluation of suspected PCa recurrence
2. Illustrate the expected post-treatment changes and patterns of PCa recurrence on MRI after most common treatment modalities

PCa Recurrence

- Occurs in 10-53% of patients, depending on risk group and treatment modality
- Typically detected by elevation in PSA levels after treatment, which can precede symptoms by months to years

Treatment modality	Biochemical (BCR) criteria
Radical Prostatectomy (RP)	Two consecutive PSA levels > 0.2 ng/mL
Radiation therapy (RT)	PSA level $\geq$ 2.0 ng/mL above nadir
Cryotherapy (Cryo)	No consensus, but some use same as RT

PCa Recurrence

- Pattern of BCR may suggest recurrence location

	Local recurrence	Distant metastasis
BCR time	Late (>24 months)	Early (<24 months)
PSA velocity	Slow	Fast
PSA doubling time (PSADT)	>6 months	<6 months

- Since tumor burden does not always correlate with serum PSA, imaging is often performed to distinguish local recurrence from distant metastases and to assist in treatment planning

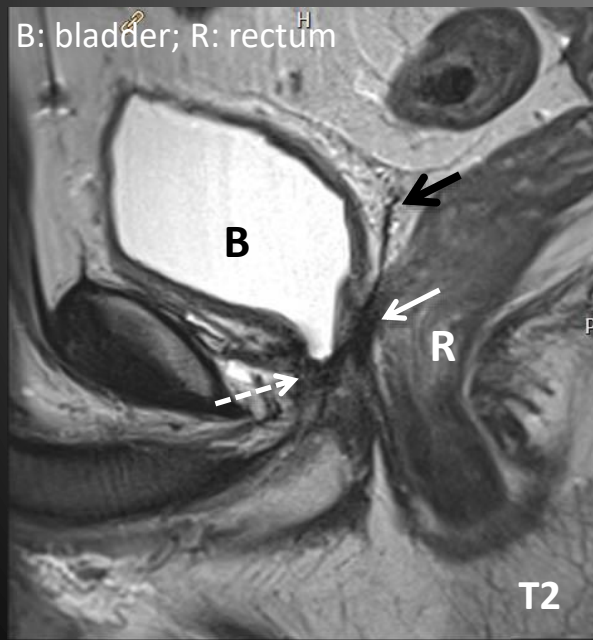
MRI in PCa Recurrence

- MRI is considered the most accurate method for detection of local PCa recurrence, even in early stages (PSA <1.0 ng/mL)
- **MRI Technique and interpretation: No consensus**
 - PI-RADS does not address PCa recurrence
 - Should not give a PI-RADS score
 - 1.5 or 3T, with or without ERC
 - Multiparametric: T2 and T1-WI, DWI, DCE
 - Evidence available suggests that DCE has greater importance in this setting than on initial detection

Radical Prostatectomy (RP)

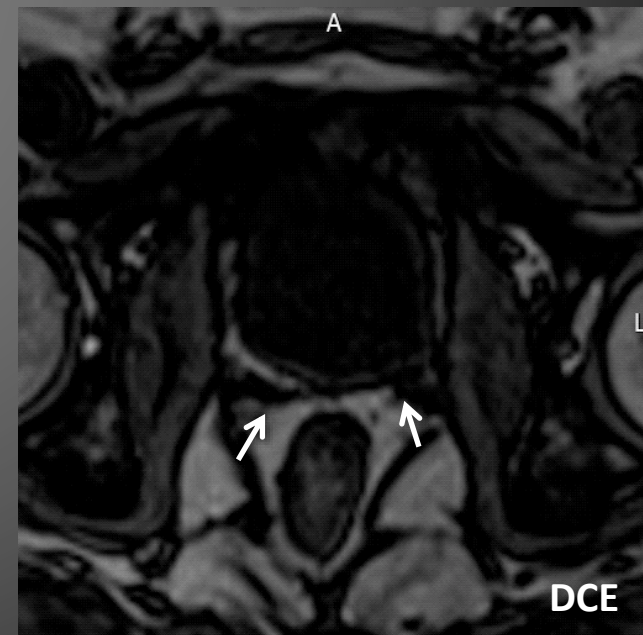
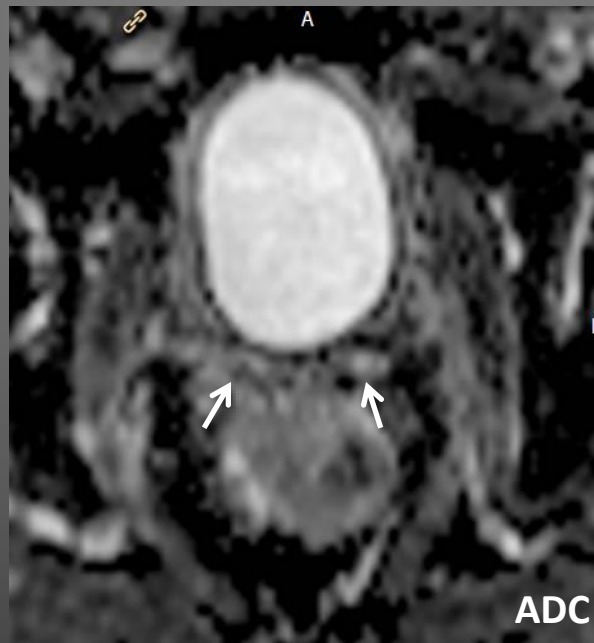
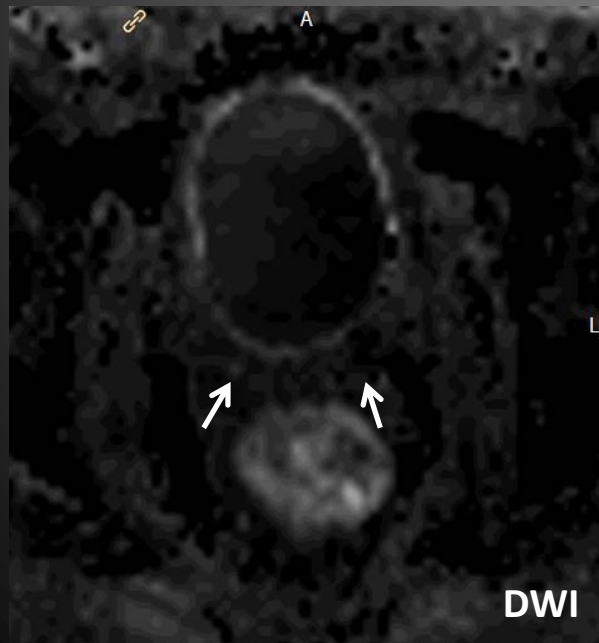
MRI after RP – Expected Findings

- Bladder descends towards the rectum
- **Fibrotic tissue** develops in the prostatectomy bed and vesicoureteral anastomosis
 - T2-WI: fibrotic tissue shows dark signal
 - DWI/ADC: no restricted diffusion
 - DCE: delayed and progressive enhancement



MRI after RP – Expected Findings

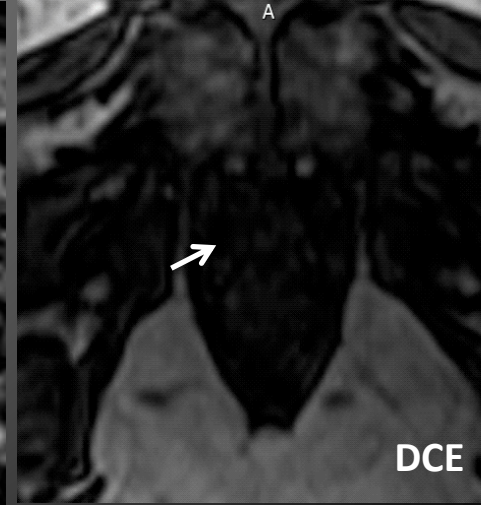
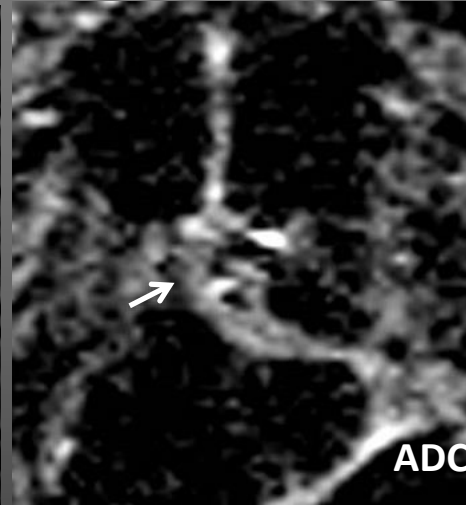
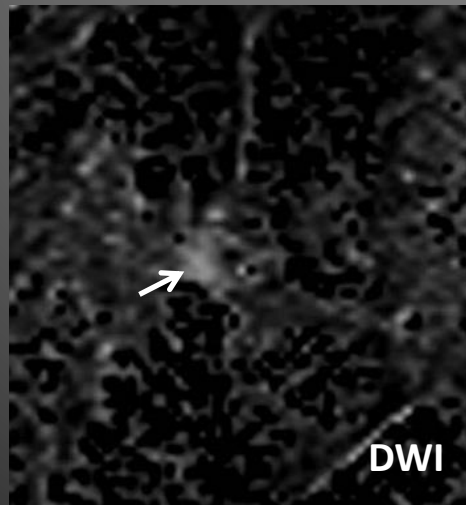
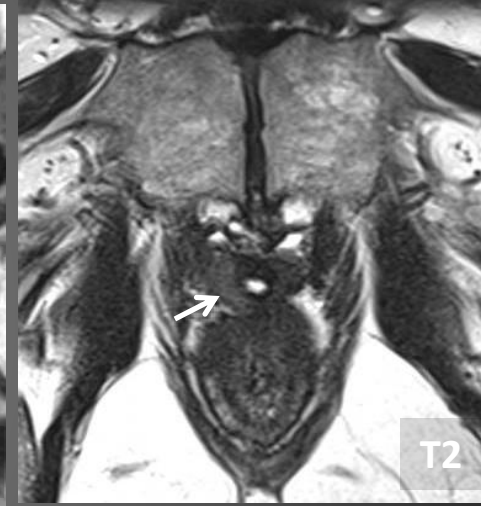
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 - DWI/ADC: no restricted diffusion
 - DCE: delayed and progressive enhancement



MRI after RP – Recurrence

- Most common locations:
perianastomotic, retrovesical,
or in the SV bed
- MRI features:
 - T2-WI: nodular lesion with intermediate SI
 - DWI/ADC: restricted diffusion
 - DCE: early enhancement +/- wash-out

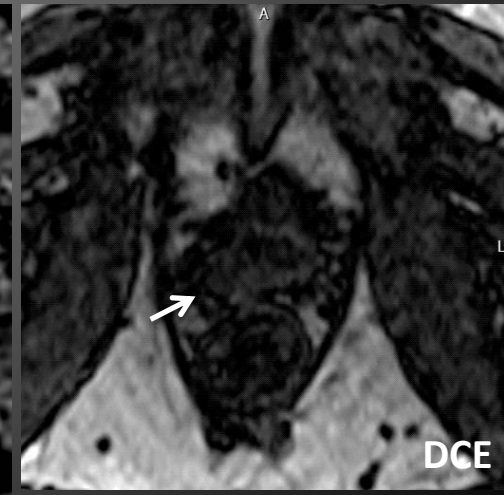
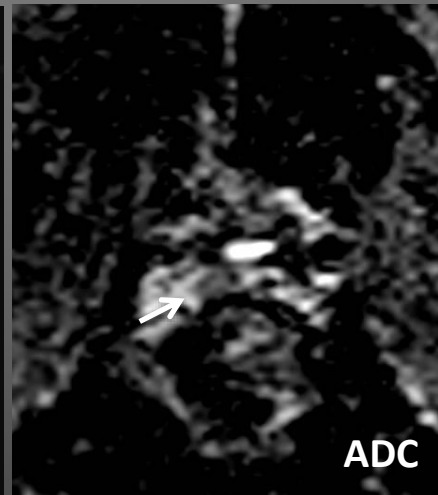
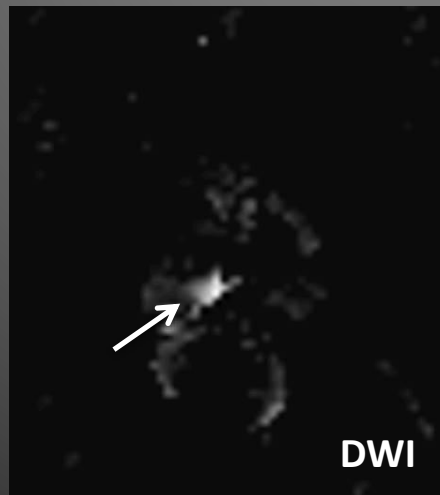
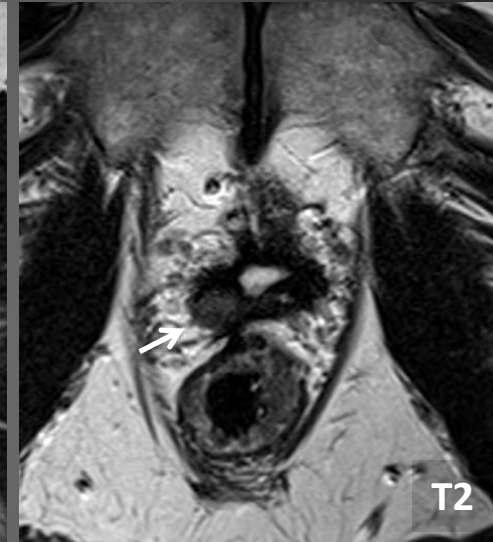
78 y.o man s/p RP for GS 4+3 stage T2b PCa
presents with BCR (PSA: 2.0ng/mL)



MRI after RP – Recurrence

- Most commonly locations:
perianastomotic, retrovesical,
or in the SV bed
- MRI features:
 - T2-WI: nodular lesion with intermediate SI
 - DWI/ADC: restricted diffusion
 - DCE: early enhancement +/- wash-out

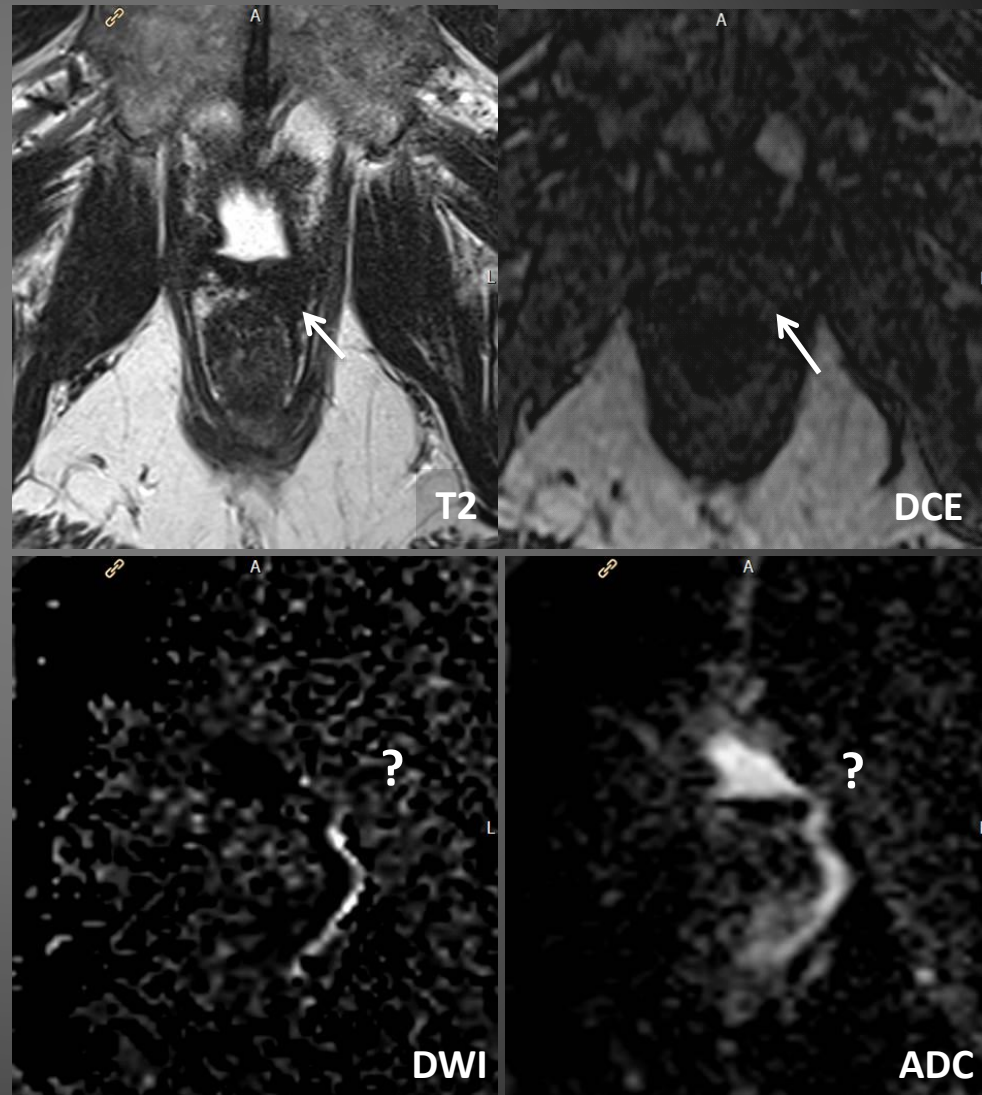
77 y.o man s/p RP for GS 3+4 stage T2b
PCa presents with BCR (PSA: 2.6ng/mL)



MRI after RP – Recurrence

- Most commonly locations: perianastomotic, **retrovesical**, or in the SV bed
- MRI features:
 - T2-WI: nodular lesion with intermediate SI
 - DWI/ADC: restricted diffusion
 - DCE: early enhancement +/- wash-out

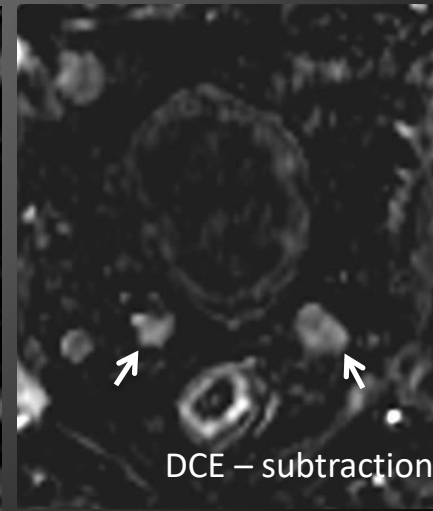
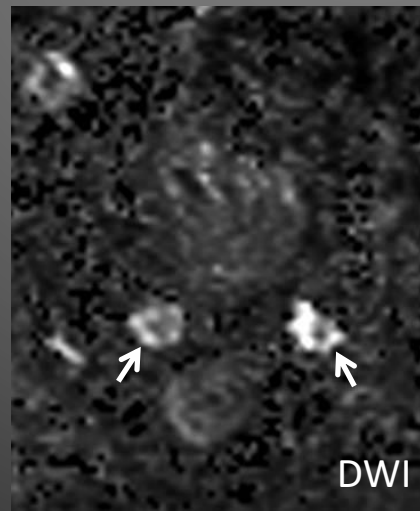
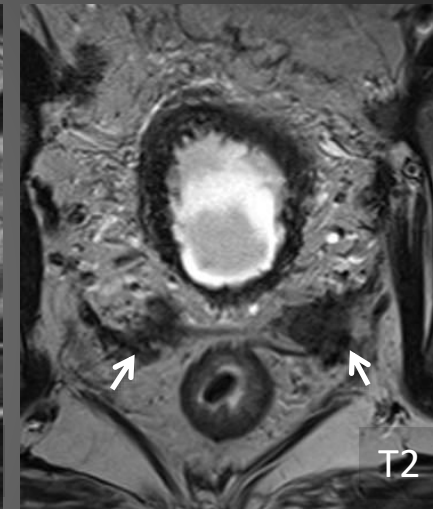
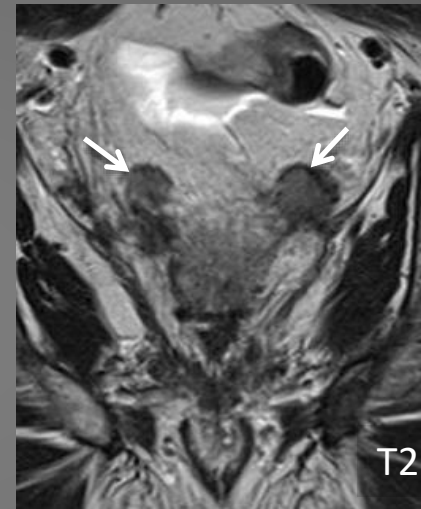
59 y.o man s/p RP for GS 4+3 stage T3a PCa presents with BCR (PSA: 1.14ng/mL)



MRI after RP – Recurrence

- Most commonly locations: perianastomotic, retrovesical, or in the **SV bed**
- MRI features:
 - T2-WI: nodular lesion with intermediate SI
 - DWI/ADC: restricted diffusion
 - DCE: early enhancement +/- wash-out

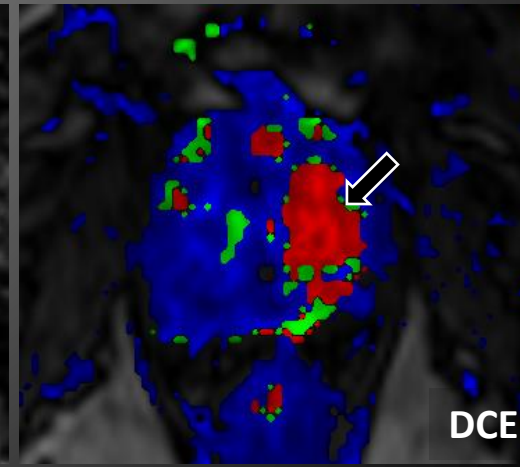
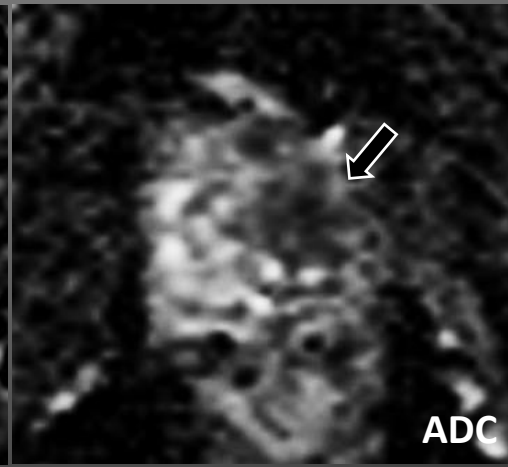
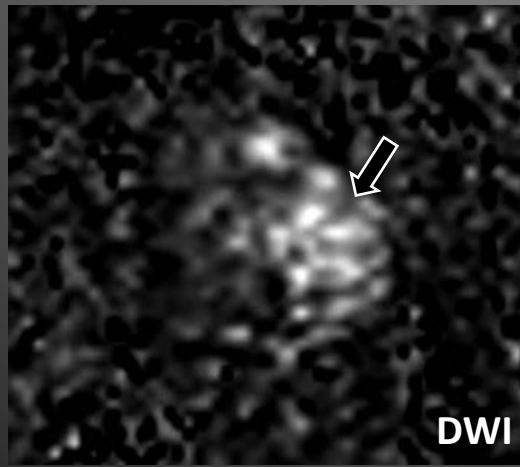
68 y.o. man s/p RP and RT for GS 4+5 stage T3b PCa who presented with BCR after stopping ADT (PSA 3.9ng/ml)



MRI after RP – Residual Disease

- PSA should be undetectable 12 weeks after RP
- Failure to decrease PSA is caused by residual PCa or normal prostatic tissue
- Positive surgical margin is an indicator of residual disease

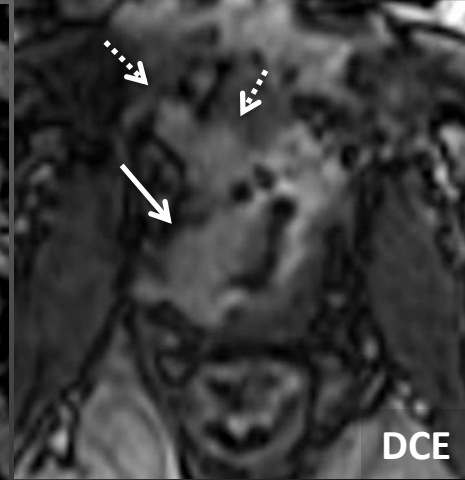
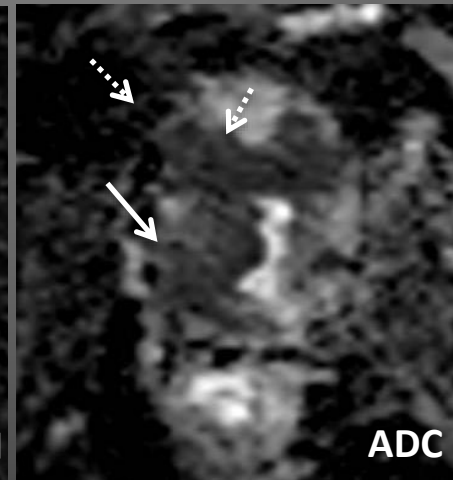
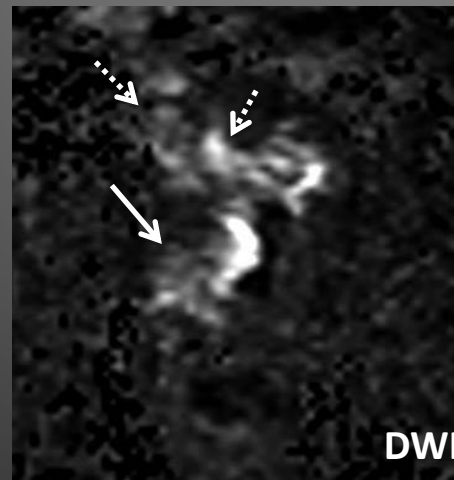
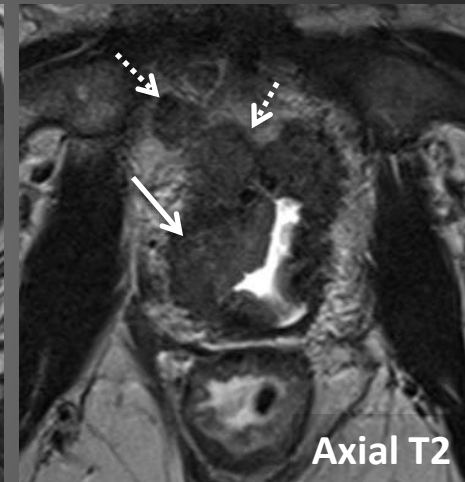
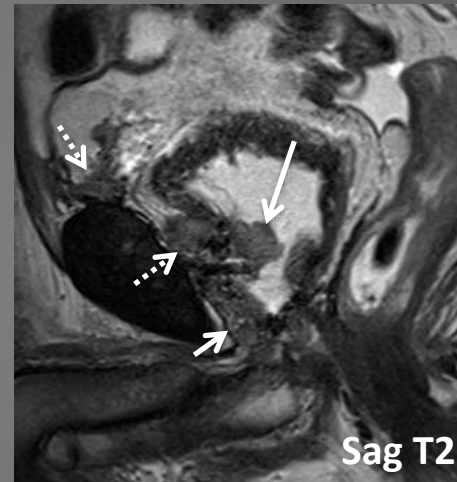
PCa GS 5 + 4 on TRUS bx and PSA 13.4 ng/mL.



MRI after RP – Residual Disease

- PSA should be undetectable 12 weeks after RP
- Failure to decrease PSA is caused by residual PCa or normal prostatic tissue
- Positive surgical margin is an indicator of residual disease

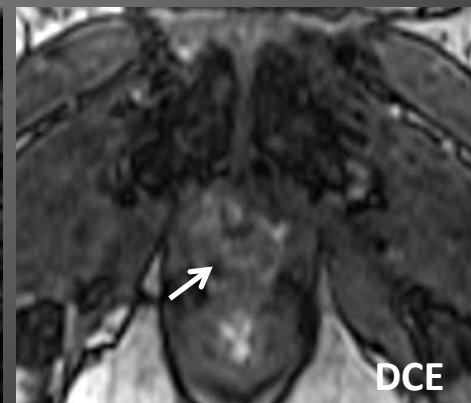
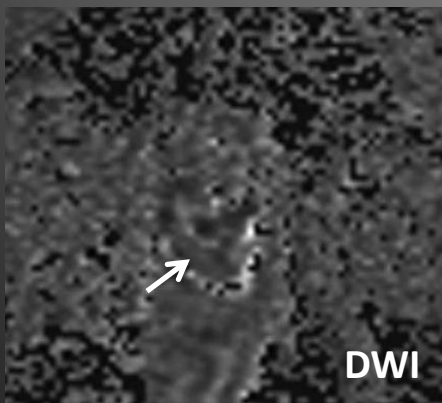
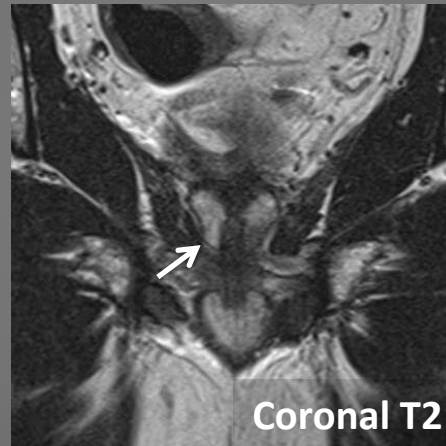
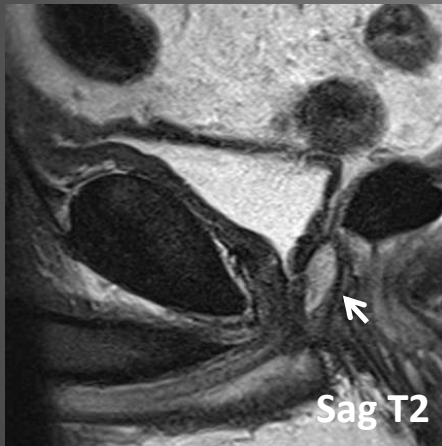
Post-op PSA: 140ng/mL



MRI after RP – Residual Prostate

- Residual prostatic tissue and SV occurs in 10-50% of cases
- Should have SI similar to that of normal prostatic tissue

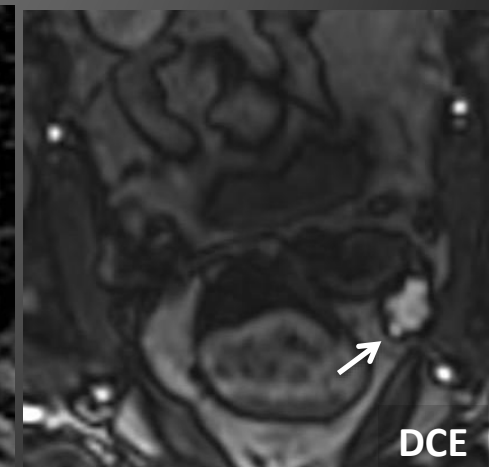
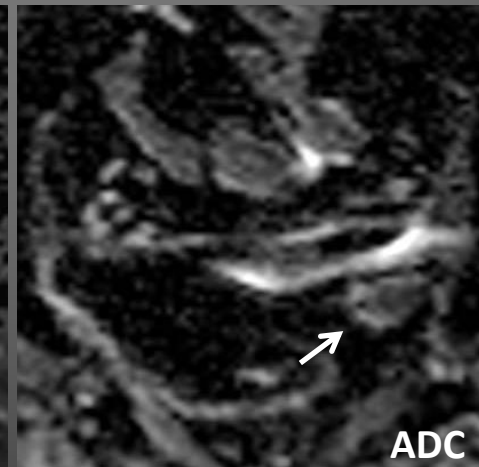
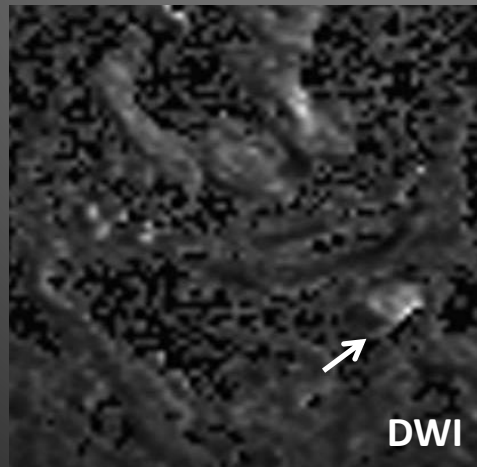
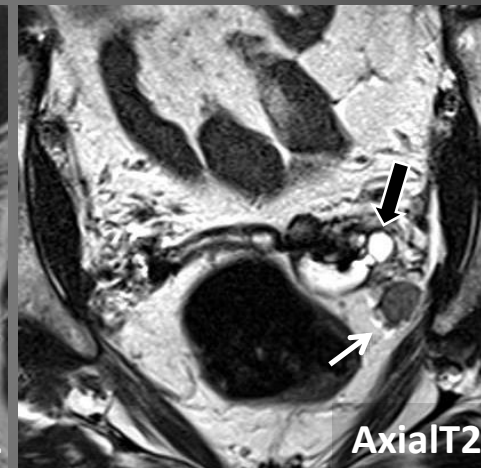
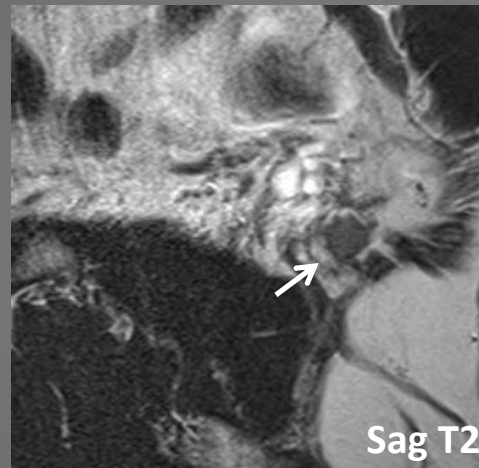
73 y.o. man s/p RP for a GS 3+4 stage T2b PCa with persistently elevated but stable post-op PSA (1.27ng/mL). TRUS revealed a small hypoechoic mass at the base of the bladder concerning for recurrence



MRI after RP – Other sites

- MRI can also help detect lymph node involvement in the pelvis and lower retroperitoneum as well as pelvic bone metastases
 - **Lymph node metastasis:** >1cm (short axis), heterogeneous signal, irregular borders
 - **Bone metastasis:** Low T1-WI SI, restricted diffusion and early enhancement

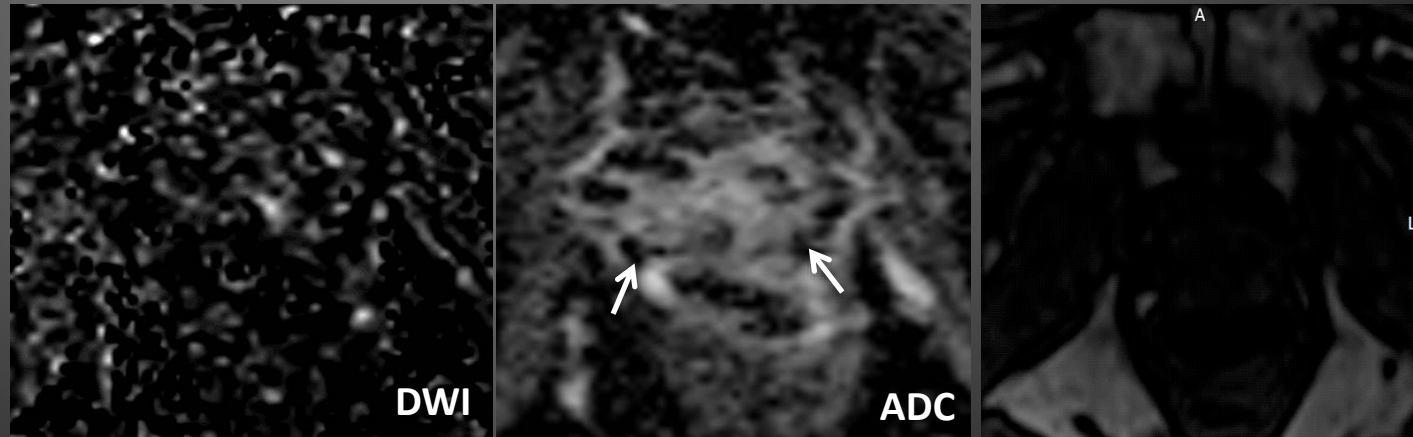
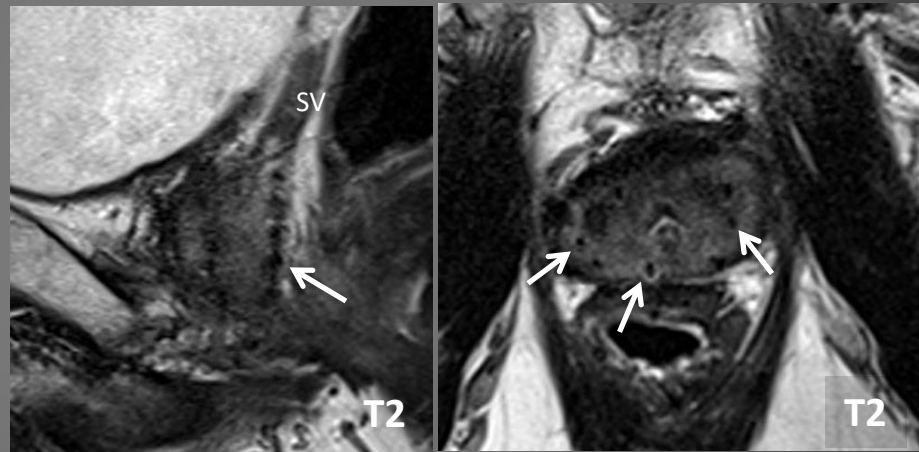
59 y.o. man s/p RP for GS 4+3 stage T3a PCa with persistently elevated post-op PSA 1.8ng/mL



Radiation Therapy (RT)

MRI after RT– Expected findings

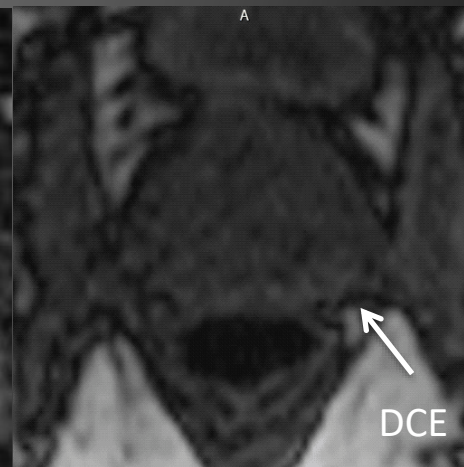
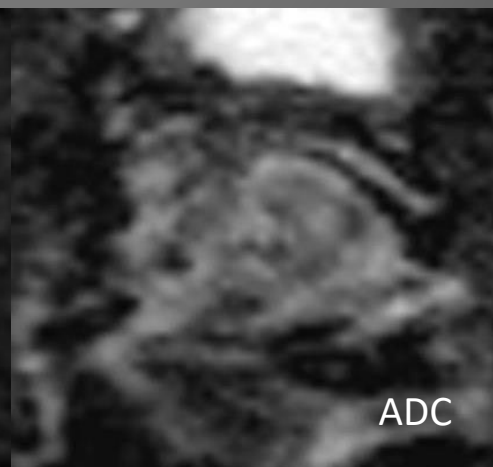
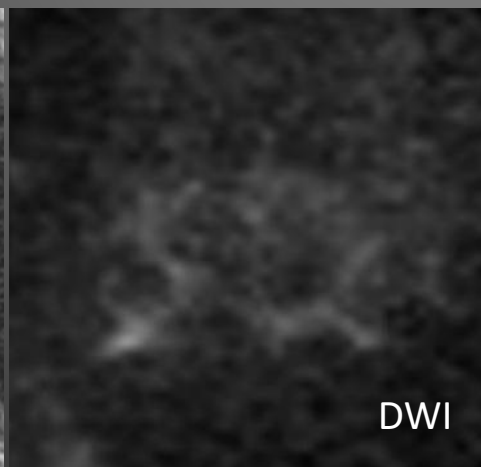
- Prostate and SV become atrophic
- T2-WI: diffuse low SI; there may be loss of zonal anatomy
- DWI/ADC: no restricted diffusion
- DCE: Decreased and delayed enhancement except for urethra and residual BPH



MRI after RT– Recurrence

- Local recurrence occurs in the site of original disease
- DCE assumes a key role since T2-WI and DWI/ADC may be affected by post-treatment changes and susceptibility artifacts
 - T2-WI: nodular lesion with iso/hypointense SI
 - DWI/ADC: restricted diffusion
 - DCE: early enhancement +/- wash-out

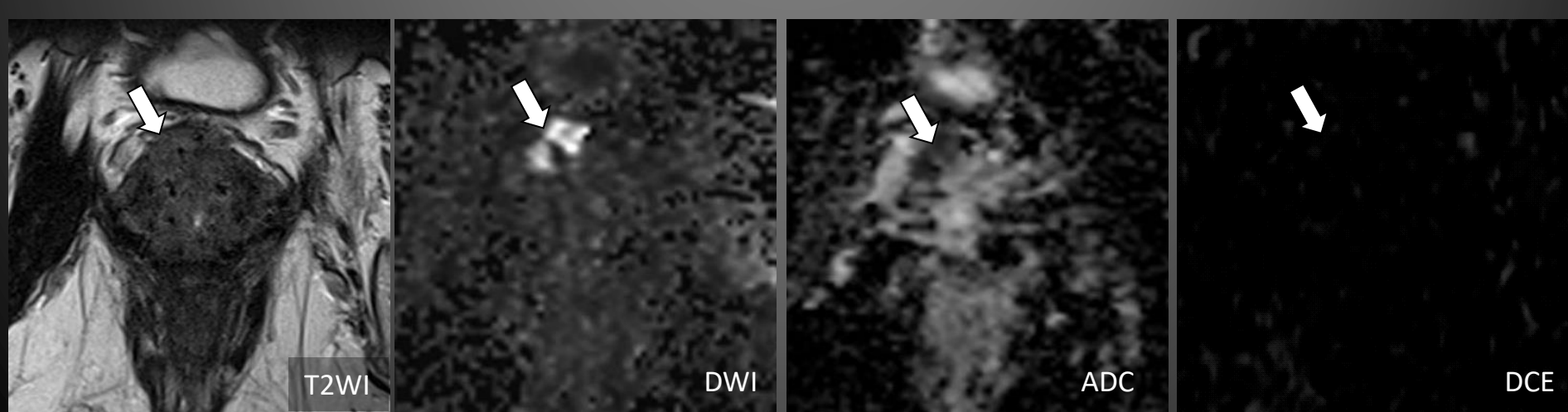
72 y.o. man s/p **Brachytherapy** for GS 3+4 PCa detected by TRUS biopsy of left sided sextants, presents with BCR (PSA 6.1 ng/mL)



MRI after RT– Recurrence

- Local recurrence occurs in the site of original disease
- DCE assumes a key role since T2-WI and DWI/ADC may be affected by post-treatment changes and susceptibility artifacts
 - T2-WI: nodular lesion with iso/hypointense SI
 - DWI/ADC: restricted diffusion
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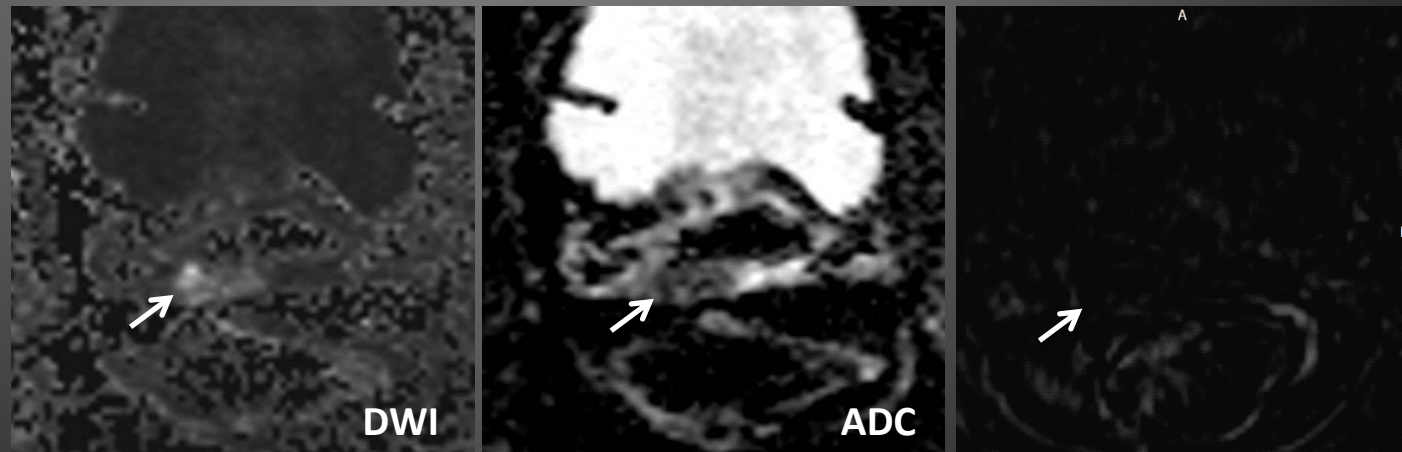
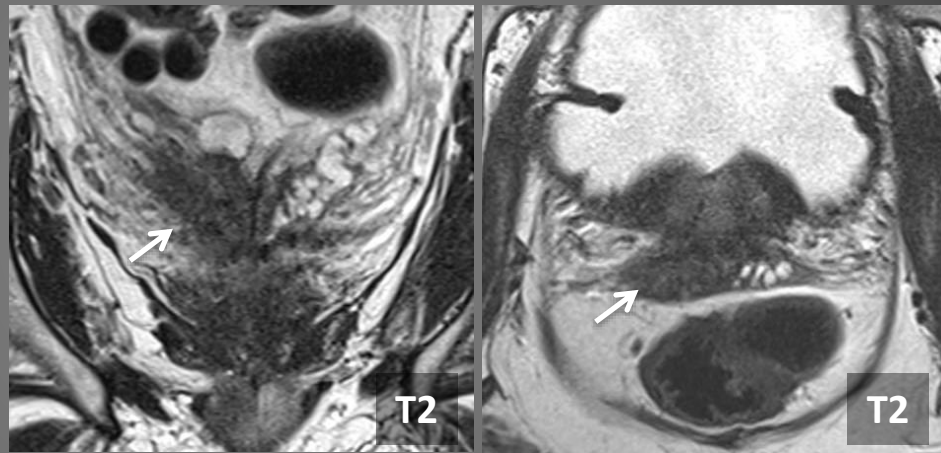
78 y.o. man s/p **Brachytherapy** for GS 4 + 5 PCa,
presents with BCR (PSA 24 ng/mL)



MRI after RT– Recurrence

- Local recurrence occurs in the site of original disease
- DCE assumes a key role since T2-WI and DWI/ADC may be affected by post-treatment changes and susceptibility artifacts

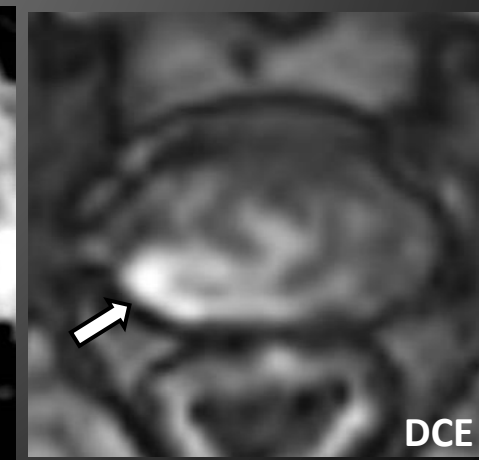
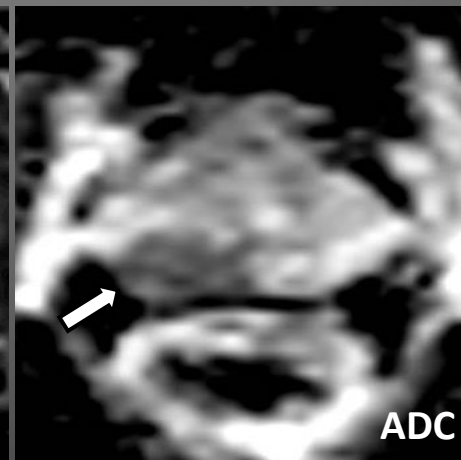
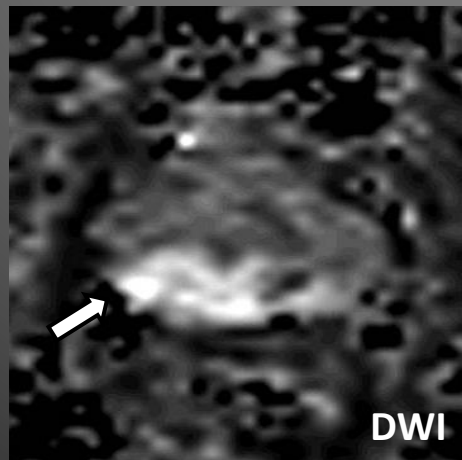
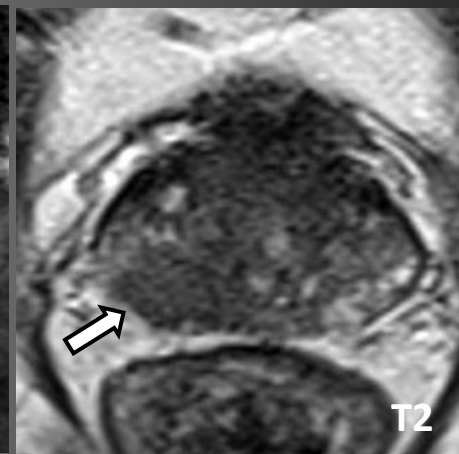
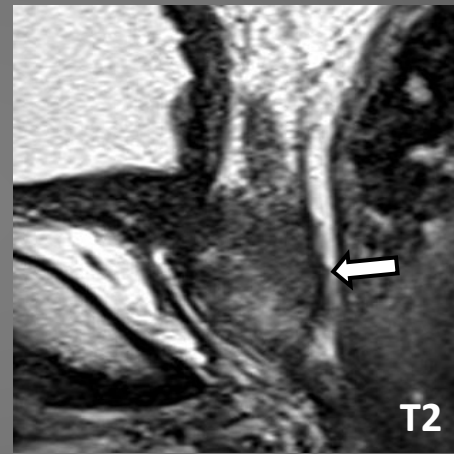
75 y.o man s/p **brachytherapy** for GS 4+3 detected by TRUS in right sided sextants, presents with BCR (PSA 3.5ng/mL)



MRI after RT– Recurrence

- After EBRT, recurrence has similar features seen with Brachytherapy
- DCE also plays an important role since post treatment changes can hamper assessment on DWI/ADC

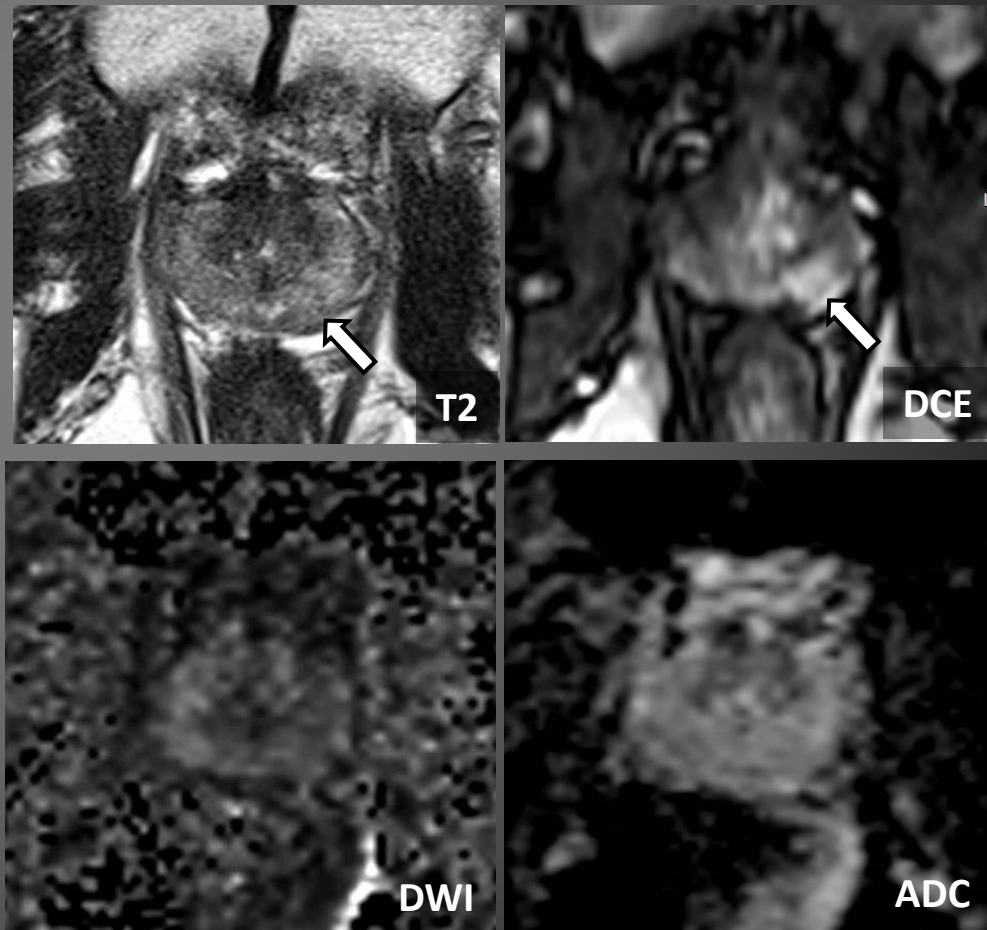
68 y.o. man s/p **EBRT** for 4+3 PCa presents with BRC (PSA 0.7ng/ml)



MRI after RT– Recurrence

- After EBRT, recurrence has similar features seen with Brachytherapy
- DCE also plays an important role since post treatment changes can hamper assessment on DWI/ADC

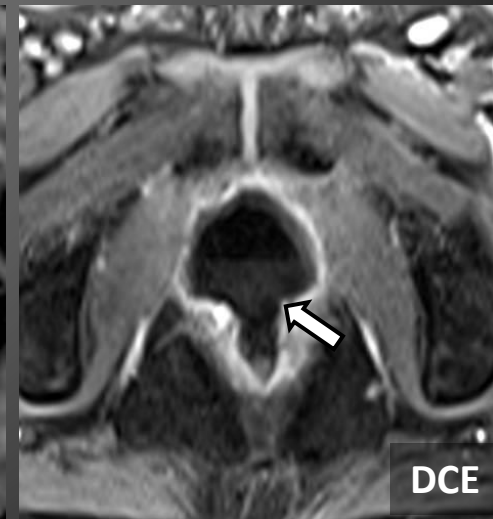
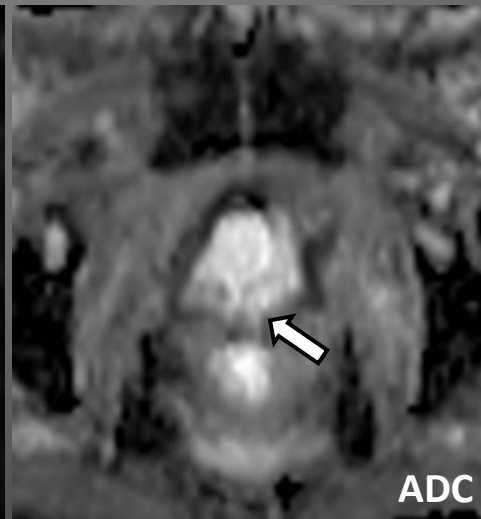
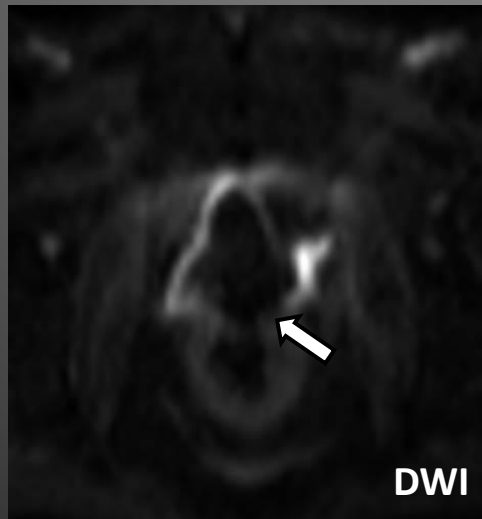
58 y.o. man s/p EBRT for 4+3 PCa presents with BRC (PSA 1.1 ng/ml)



MRI after RT – Complications

- MRI can also be helpful in the evaluation of complications after RT

72 y.o. man S/p EBRT for PCa presents with undetectable PSA but with dysuria, recurrent UTI and pelvic pain. MRI shows a large rectovesical fistula



Cryotherapy

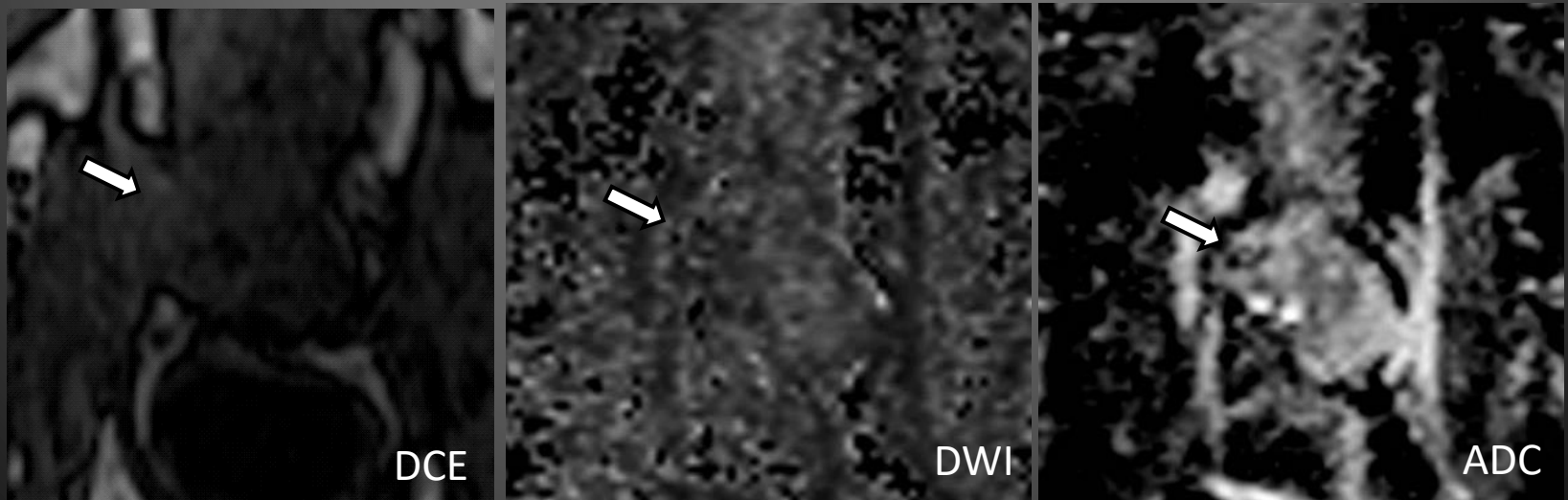
MRI after Cryotherapy – Expected findings

- Can be used to treat whole gland or as a focal therapy
- Often used to treat low risk disease or local recurrence after RT
- Fibrotic tissue develops in the ablation bed distorting the anatomical structures
 - T2-WI: irregularly shaped fibrotic tissue with low SI
 - DWI/ADC: no restricted diffusion
 - DCE: delayed and progressive enhancement



MRI after Cryotherapy – Expected findings

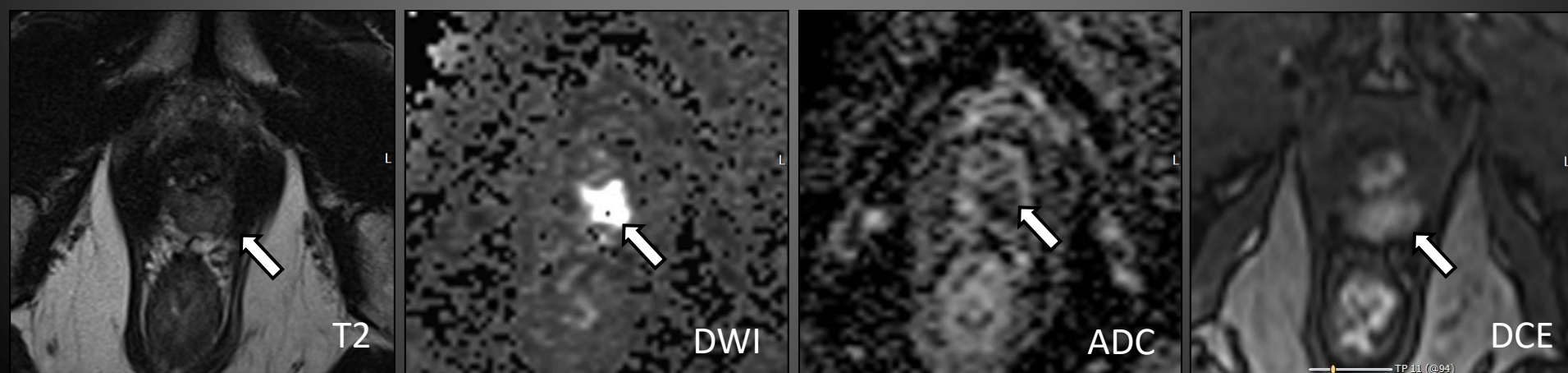
- Can be used to treat whole gland or as a focal therapy
- Often used to treat low risk disease or local recurrence after RT
- Fibrotic tissue develops in the ablation bed distorting the anatomical structures
 - T2-WI: irregularly shaped fibrotic tissue with low SI
 - DWI/ADC: no restricted diffusion
 - DCE: delayed and progressive enhancement



MRI after Cryotherapy – Recurrence

- PSA is a less reliable method for evaluation of recurrence, especially when cryoablation is used for focal therapy
- Routine biopsies may be required
 - T2-WI: nodular lesion with low/intermediate SI
 - DWI/ADC: restricted diffusion
 - DCE: early enhancement +/- wash-out

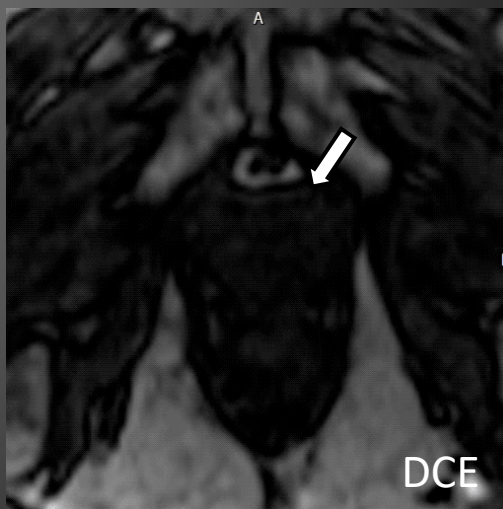
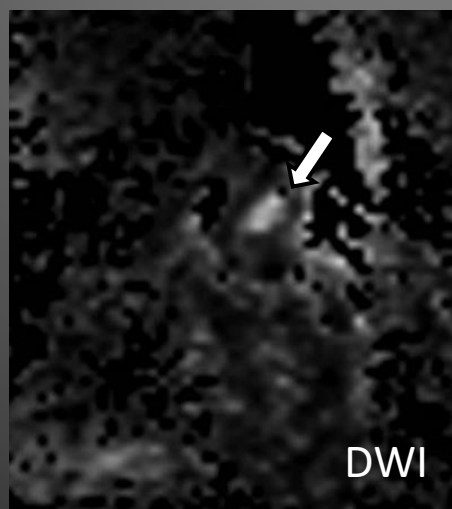
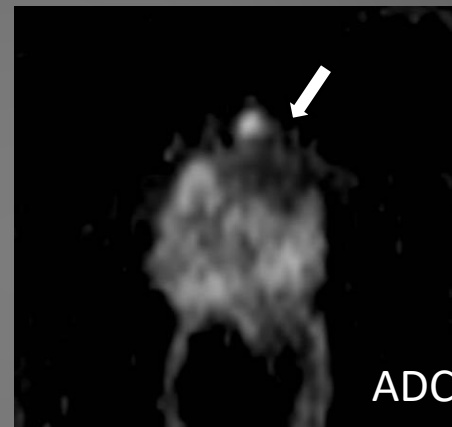
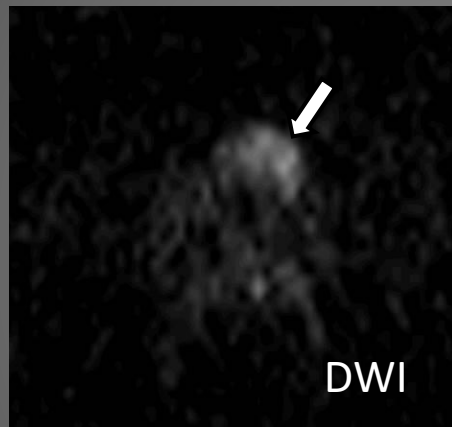
64 y.o. man with h/o GS 3+3 Pca initially treated with SBRT followed by whole gland cryo for BCR, now with rising PSA (0.8ng/mL)



MRI after Cryotherapy – Recurrence

- Pre-treatment images can assist in the detection of recurrence

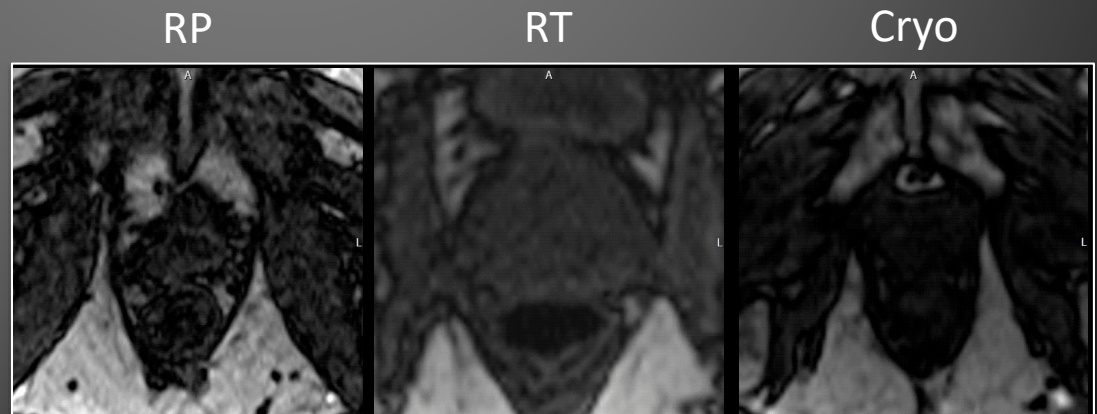
77 y.o. man with h/o GS 3+4 Pca initially treated with SBRT followed by whole gland cryo for BCR, now with rising PSA (3.37ng/mL)



Teaching Points

- PCa recurrence is a common problem, especially in patients with high risk disease
- Mp-MRI is an important tool for evaluation of residual/recurrent disease in patients with persistently elevated or rising PSA after therapy
- PCa recurrence is often identified in the site of original disease
- DCE has more important role than on initial diagnosis, due to expected post-therapy changes and commonly encountered artifacts that affect

T2-WI and DWI



Thank you!