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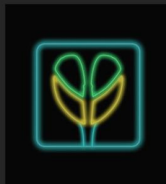
Gemelli



PI-RADS[®]

Primer for Using PI-RADS v2.1 for Prostate MRI

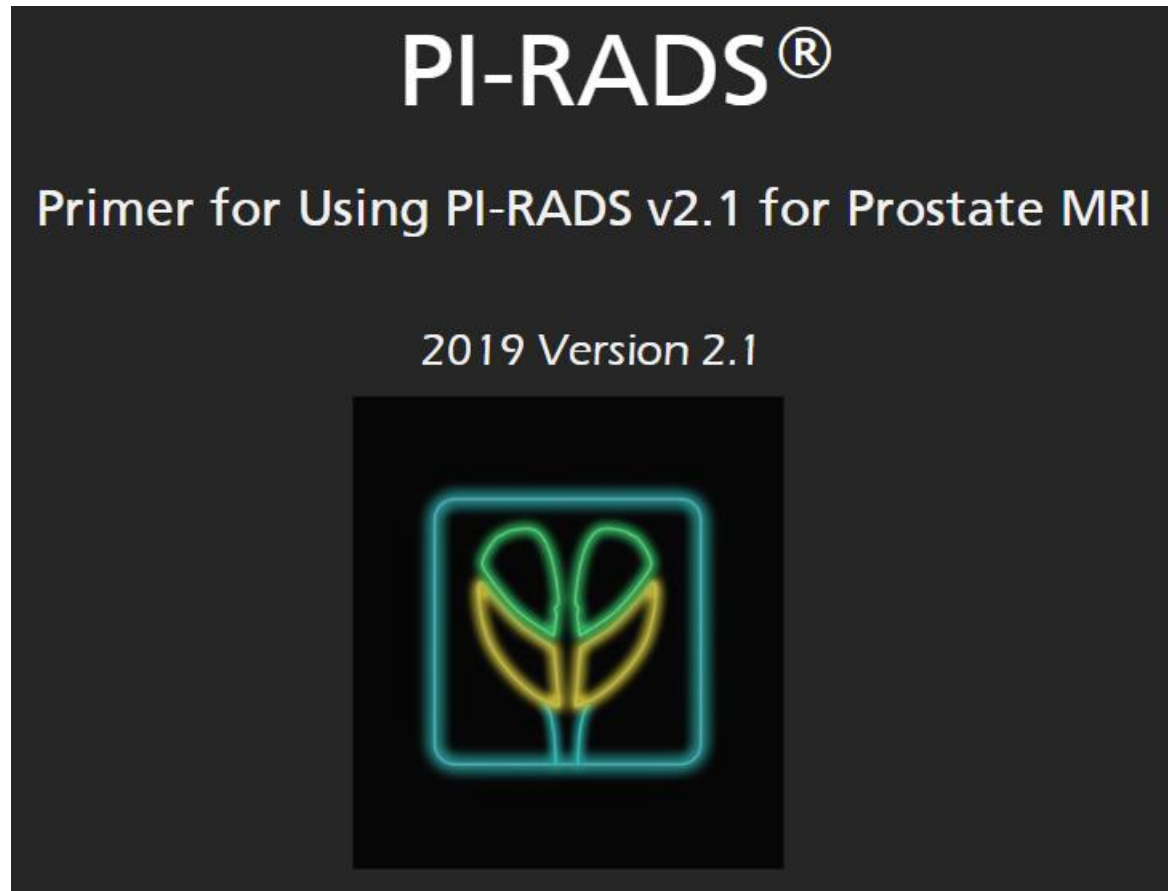
2019 Version 2.1



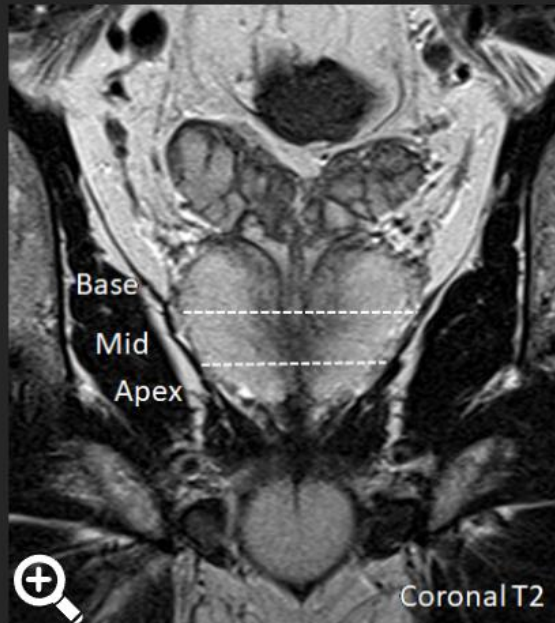
set. '23

Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore





From superior to inferior, the prostate consists of the base (just below the urinary bladder), the midgland, and the apex.

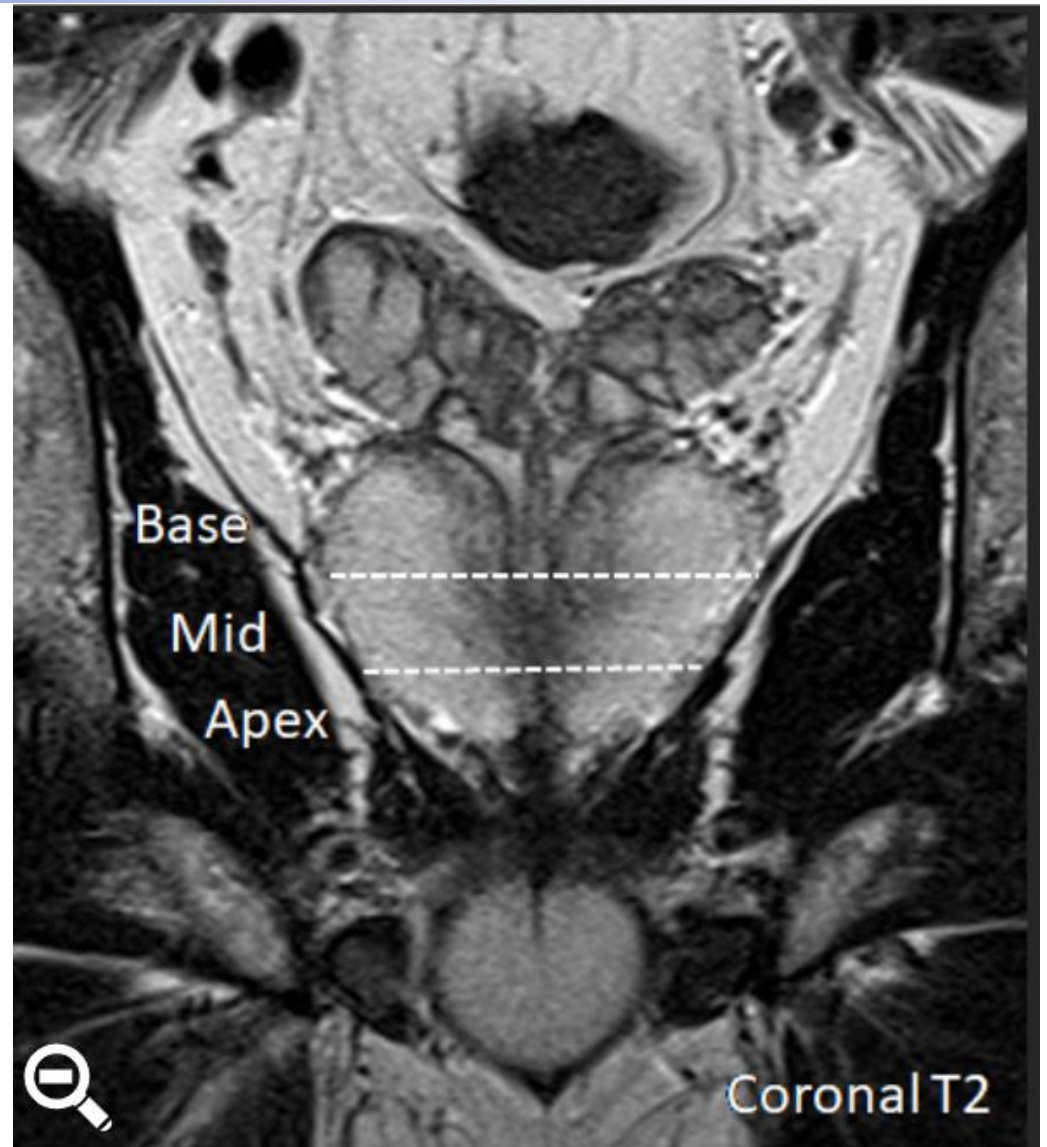


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RM Prostata

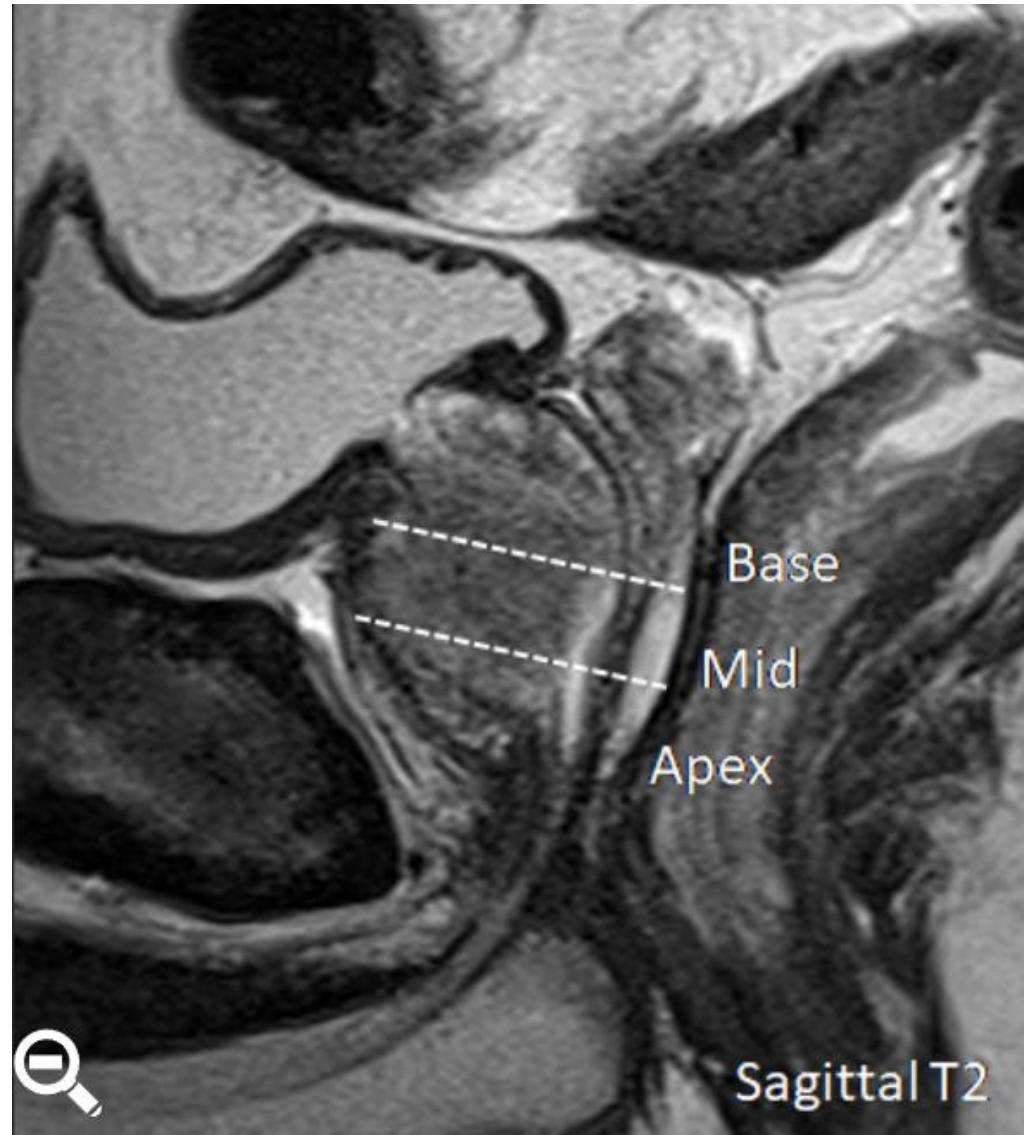
Prostate
Anatomy

Anatomy



Prostate
Anatomy








Anatomy












The prostate is also divided into four histologic zones:

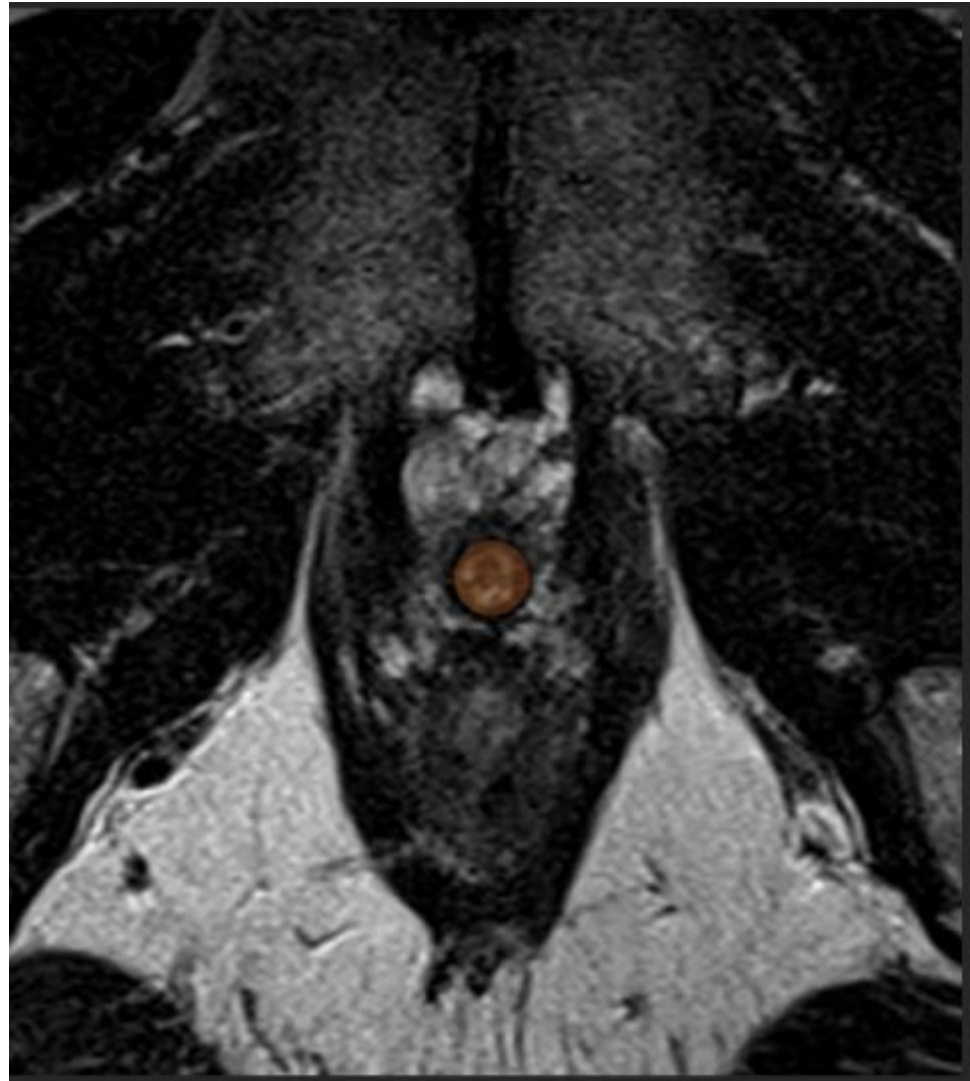
1. Peripheral zone (PZ)
2. Transition zone (TZ)
3. Central zone (CZ)
4. Anterior fibromuscular stroma (AFS)

-  Membranous urethra
-  Peripheral zone
-  Transition zone
-  Anterior fibromuscular stroma
-  Neurovascular bundle
-  Central zone
-  Seminal vesicles

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


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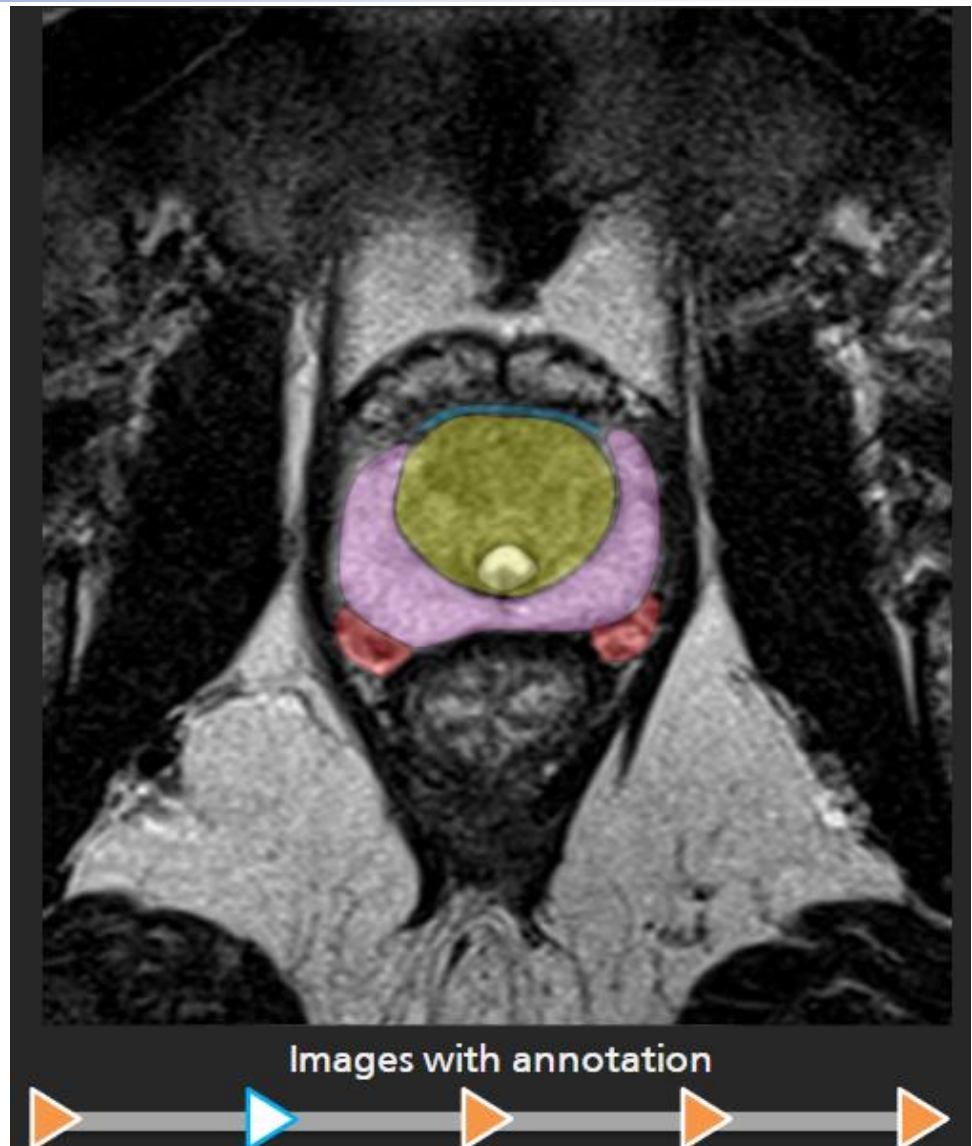
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






RM Prostata

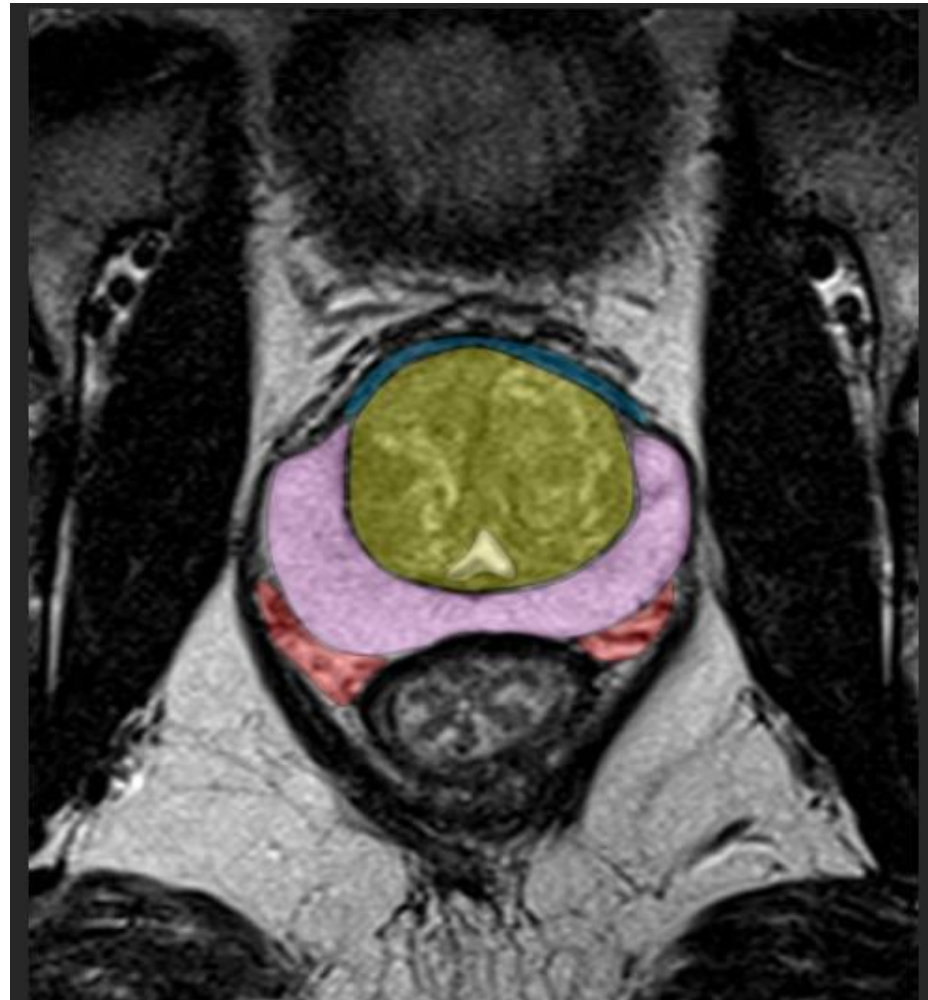
Prostate
Anatomy

Anatomy

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	Seminal vesicles



Images with annotation










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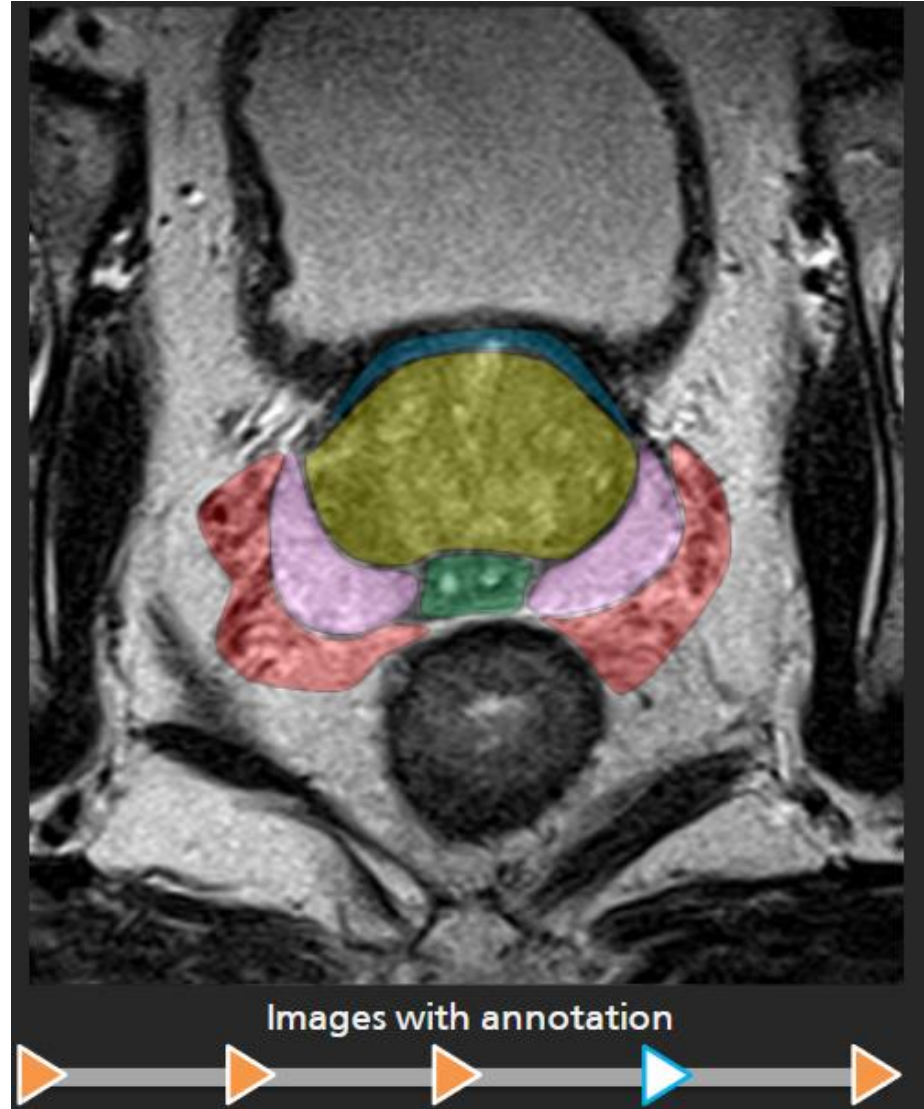
Prostate
Anatomy

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


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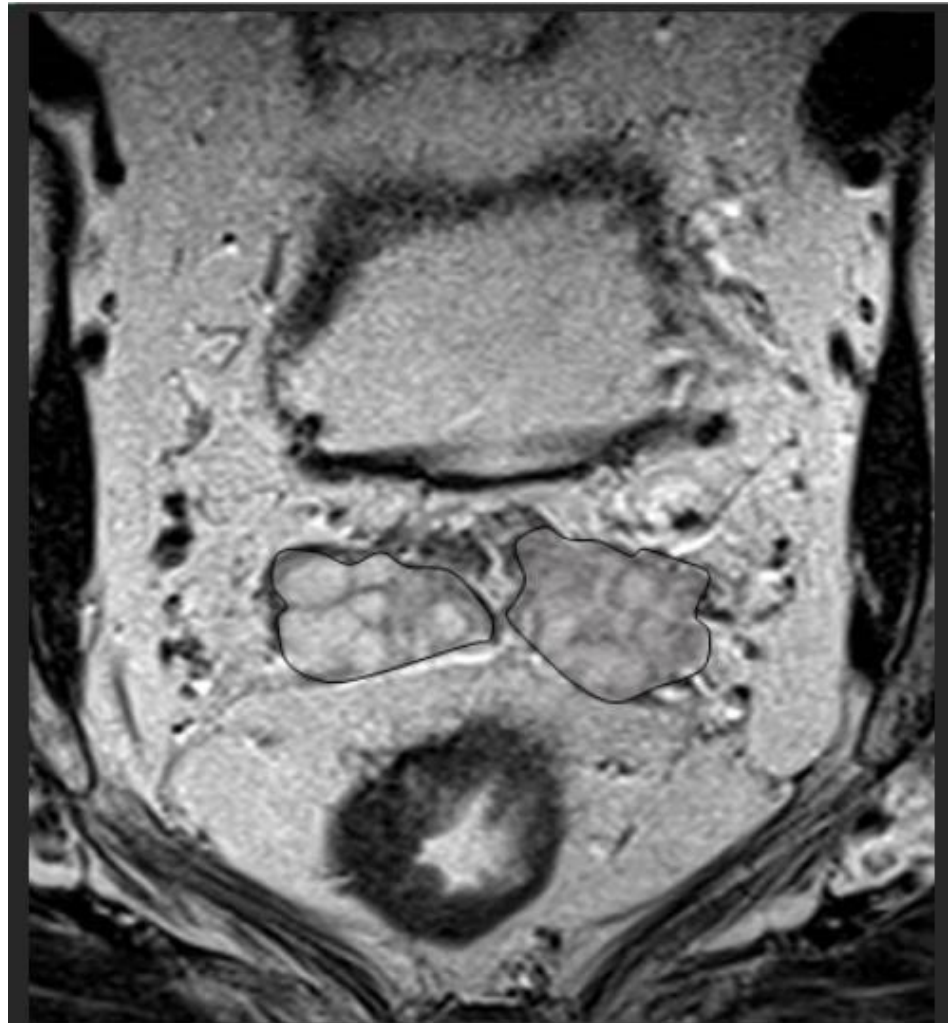
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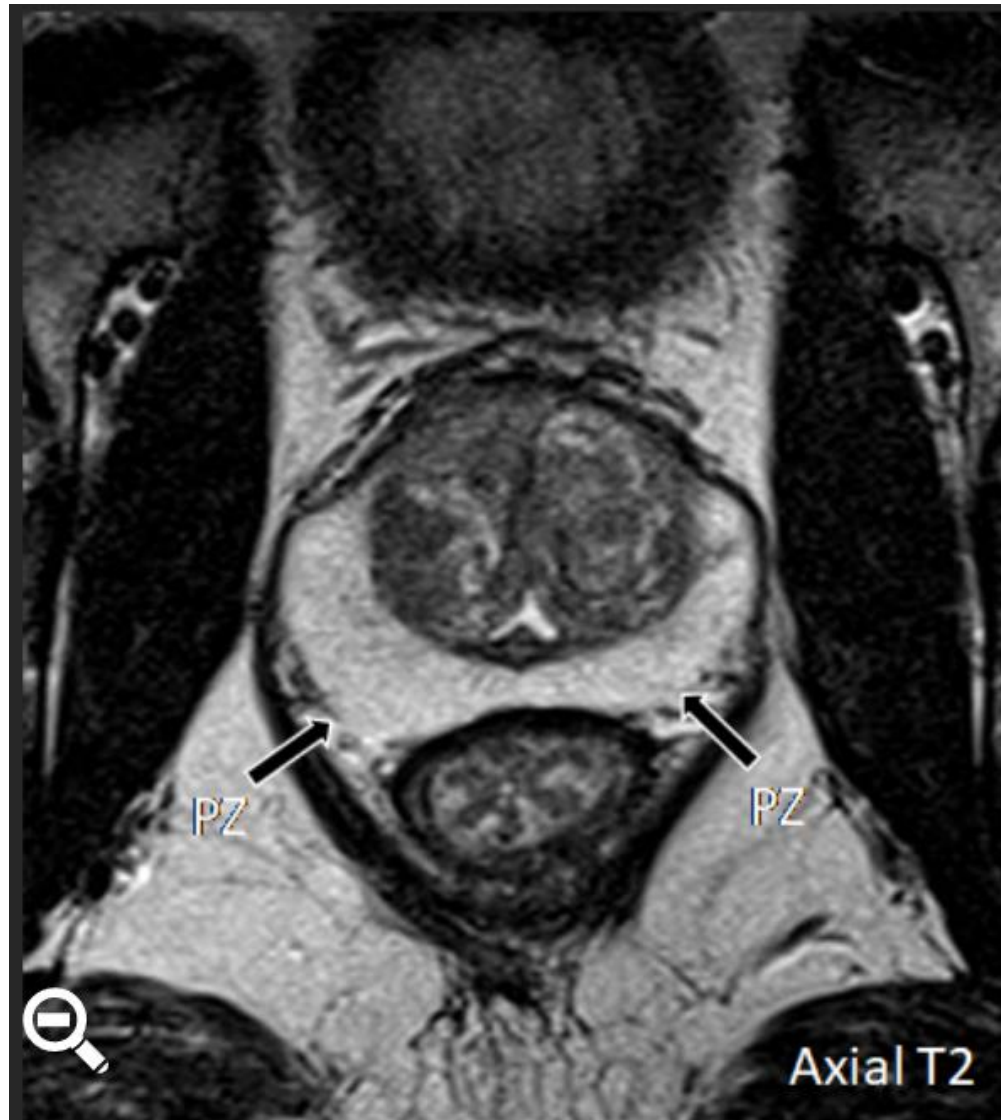


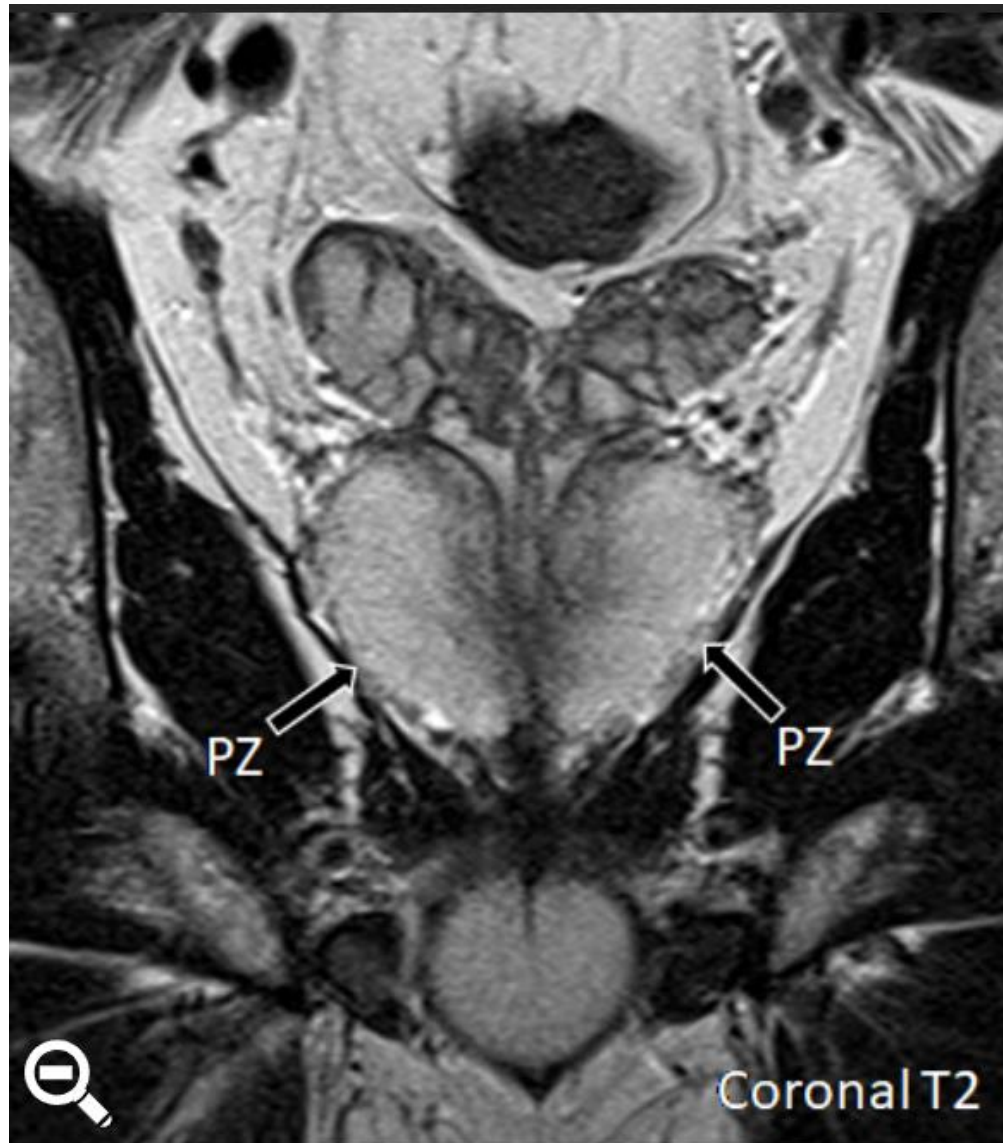
Images with annotation



- Outer portion of the prostate.
- 75-80% of the cancers develop in the PZ.
- Normal PZ has high signal intensity on T2WI, no restricted diffusion (i.e. low signal intensity on DWI and high signal intensity on ADC map) and no early arterial enhancement on DCE.







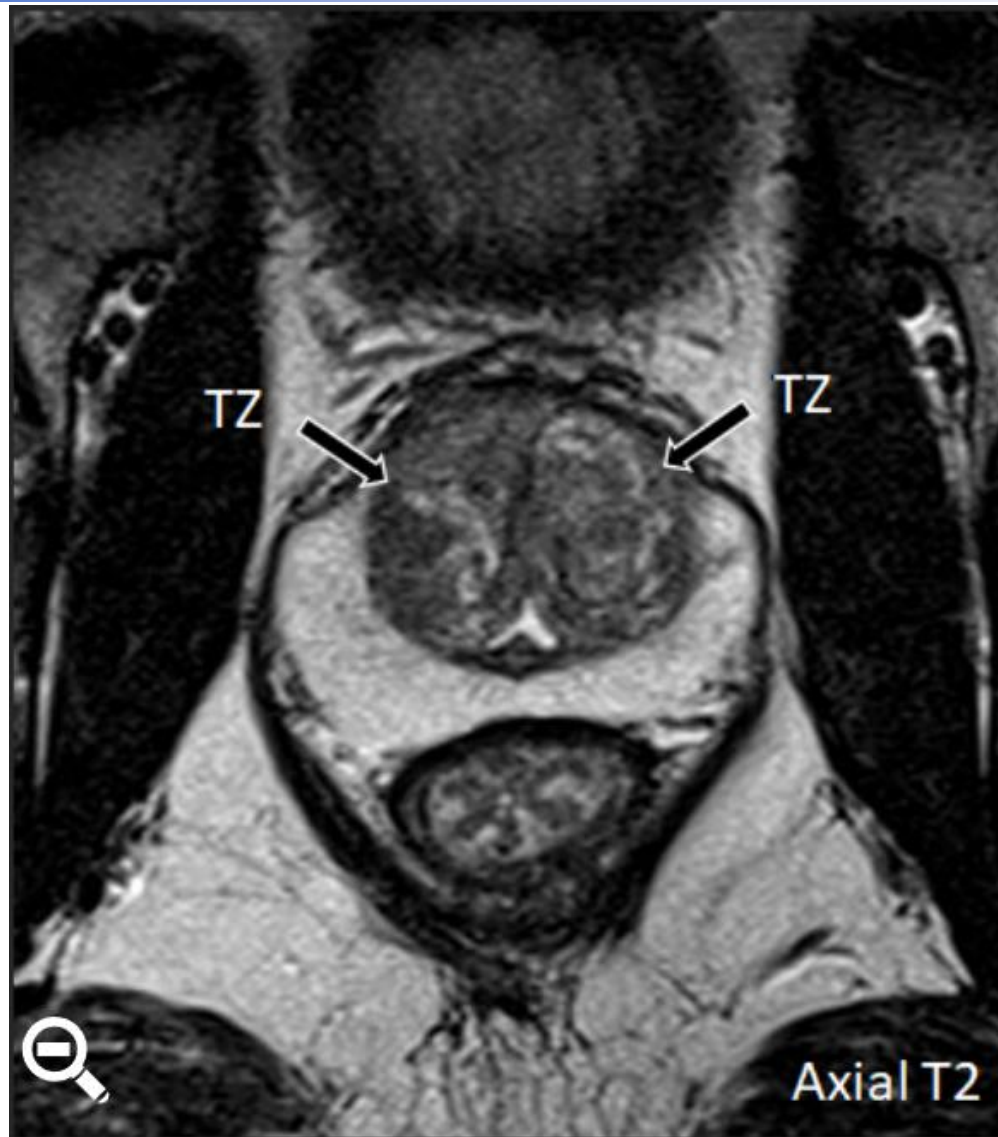


Transition Zone (TZ)

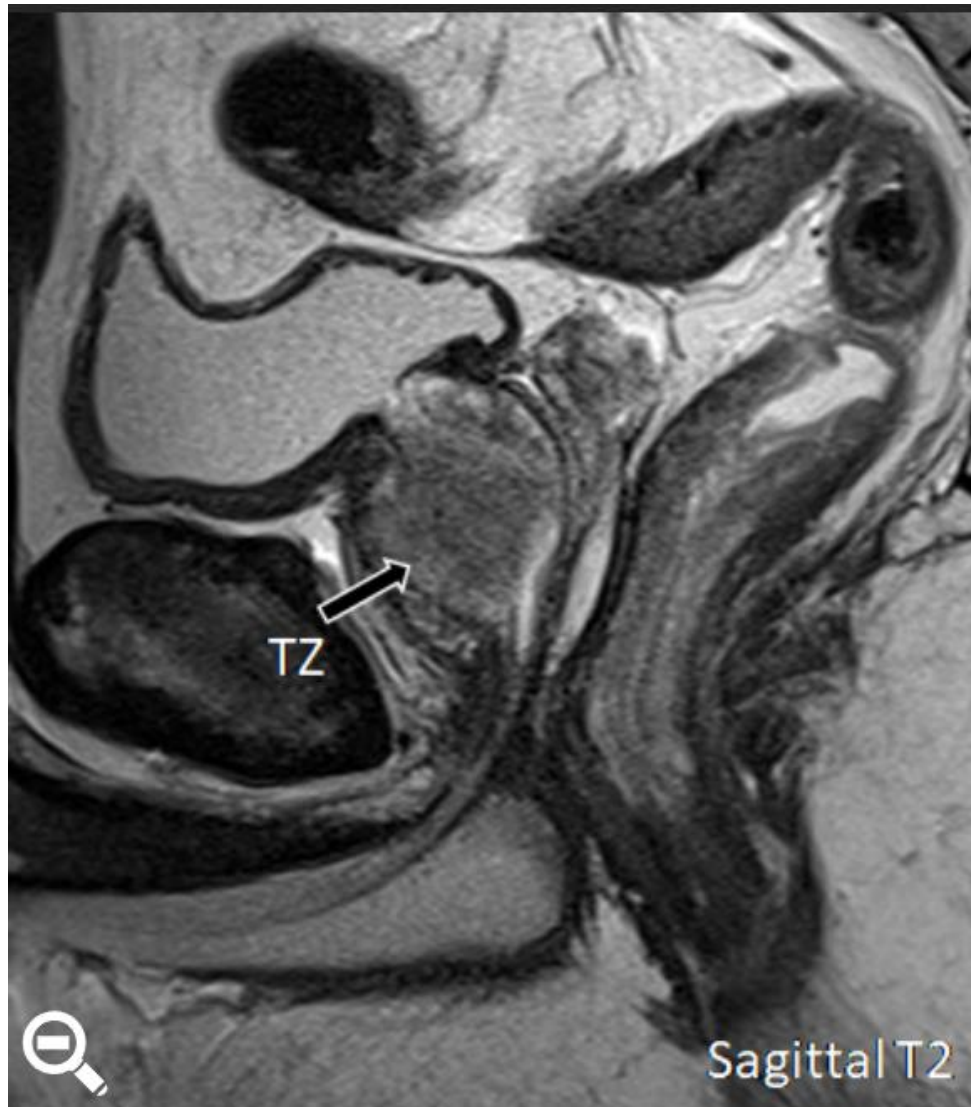
- Tissue that surrounds most of the prostatic urethra.
- 20-30% of the cancers develop in the TZ.
- TZ has a variable appearance depending on degree of hypertrophy that occurs with aging.
- In younger patients and in patients without benign prostatic hyperplasia (BPH), TZ has homogenous intermediate-low signal intensity on T2WI.
- In patients with BPH, the TZ has mixed areas of high and low signal intensity depending on the presence of glandular and fibromuscular proliferation, respectively.



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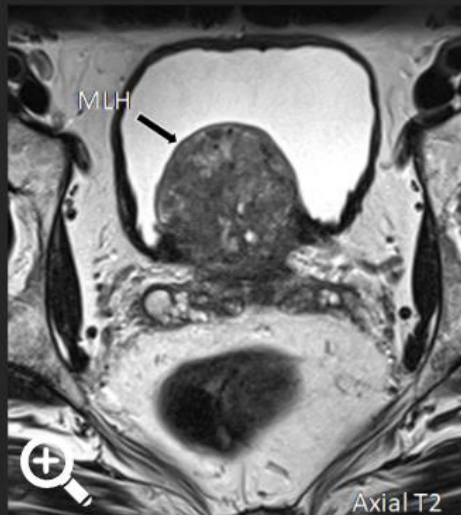




Median Lobe (ML)

6% Completed

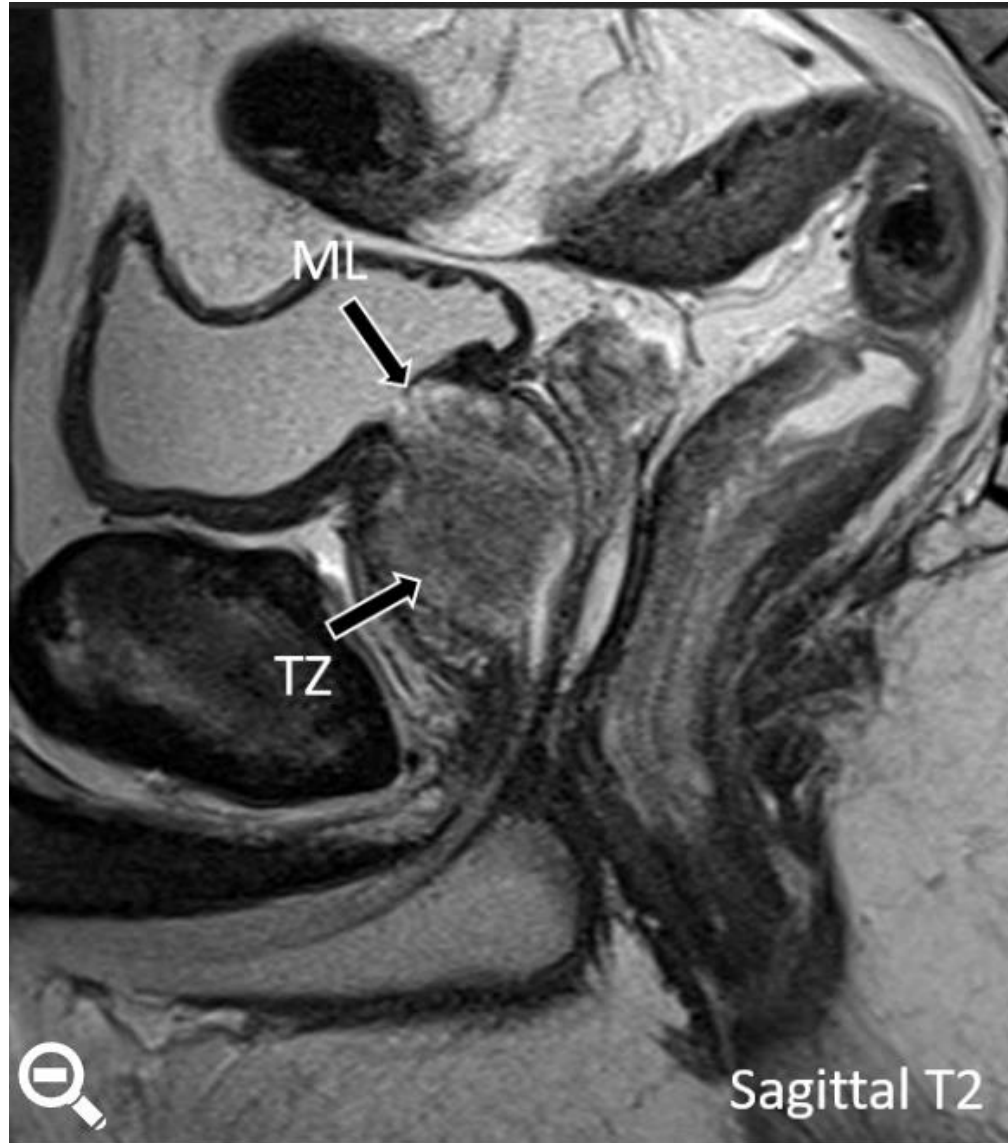
- The median lobe corresponds to portion of the TZ at the base of the prostate interfacing with the base of the bladder.
- Benign prostatic hyperplasia can affect the median lobe.
- Median lobe hypertrophy (MLH) presents as a mass of tissue that insinuates into the bladder lumen.
- Prostate cancer (PCa) rarely occurs in an hypertrophied median lobe.



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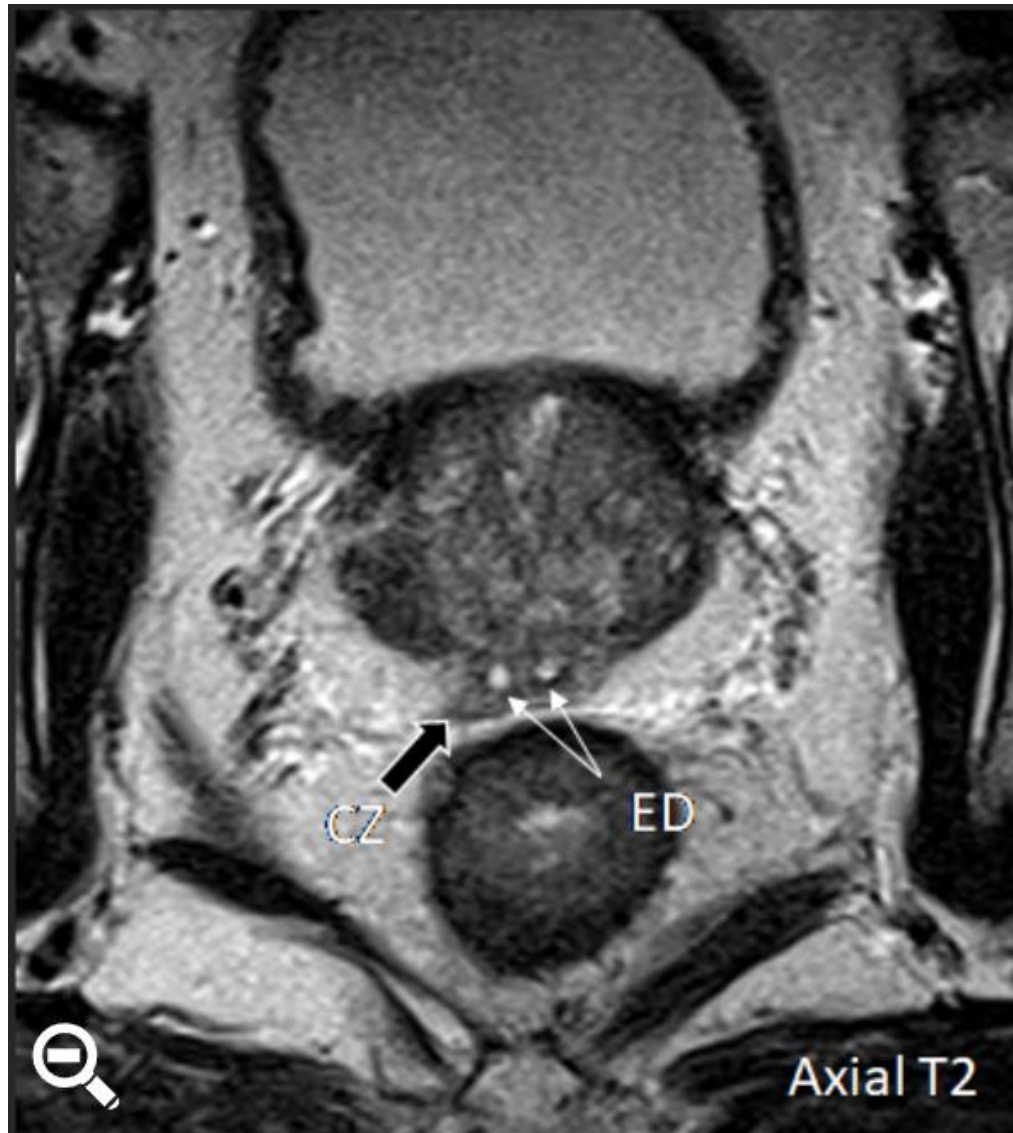




- CZ is visible and symmetric in 80% of the patients.
- Cone-shaped layer of tissue that surrounds the ejaculatory ducts (ED).
- Extends from base to the level of the mid gland where ejaculatory ducts join the urethra at the verumontanum (VM).



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Anterior Fibromuscular Stroma (AFS)

- Layer of tissue in the anterior prostate.
- It contains no glandular tissue.
- The normal AFS shows bilaterally symmetric shape ("crescentic") and symmetric low signal intensity on T2WI similar to pelvic floor or obturator muscle (OM).

AFS example 1



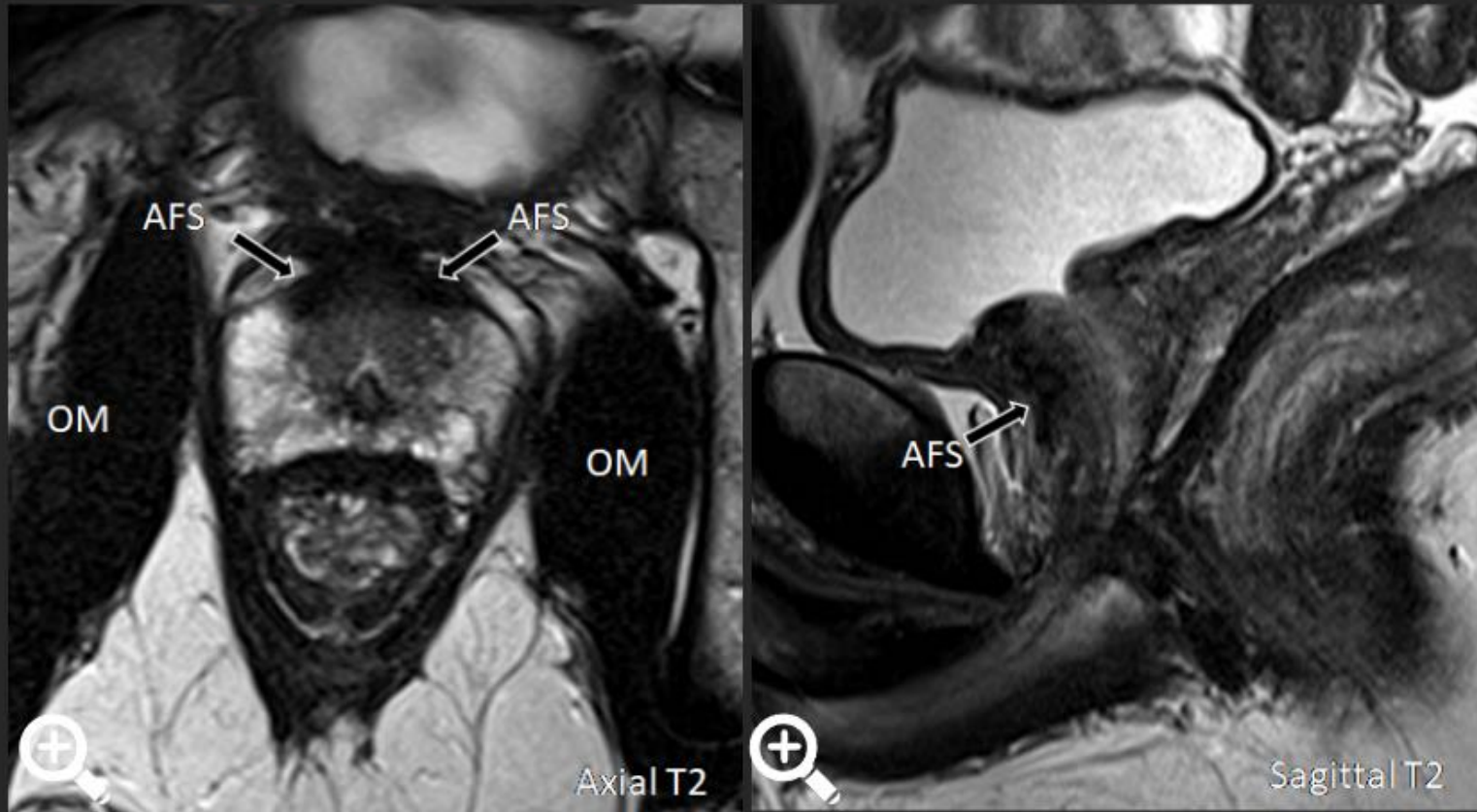
AFS example 1



AFS example 1

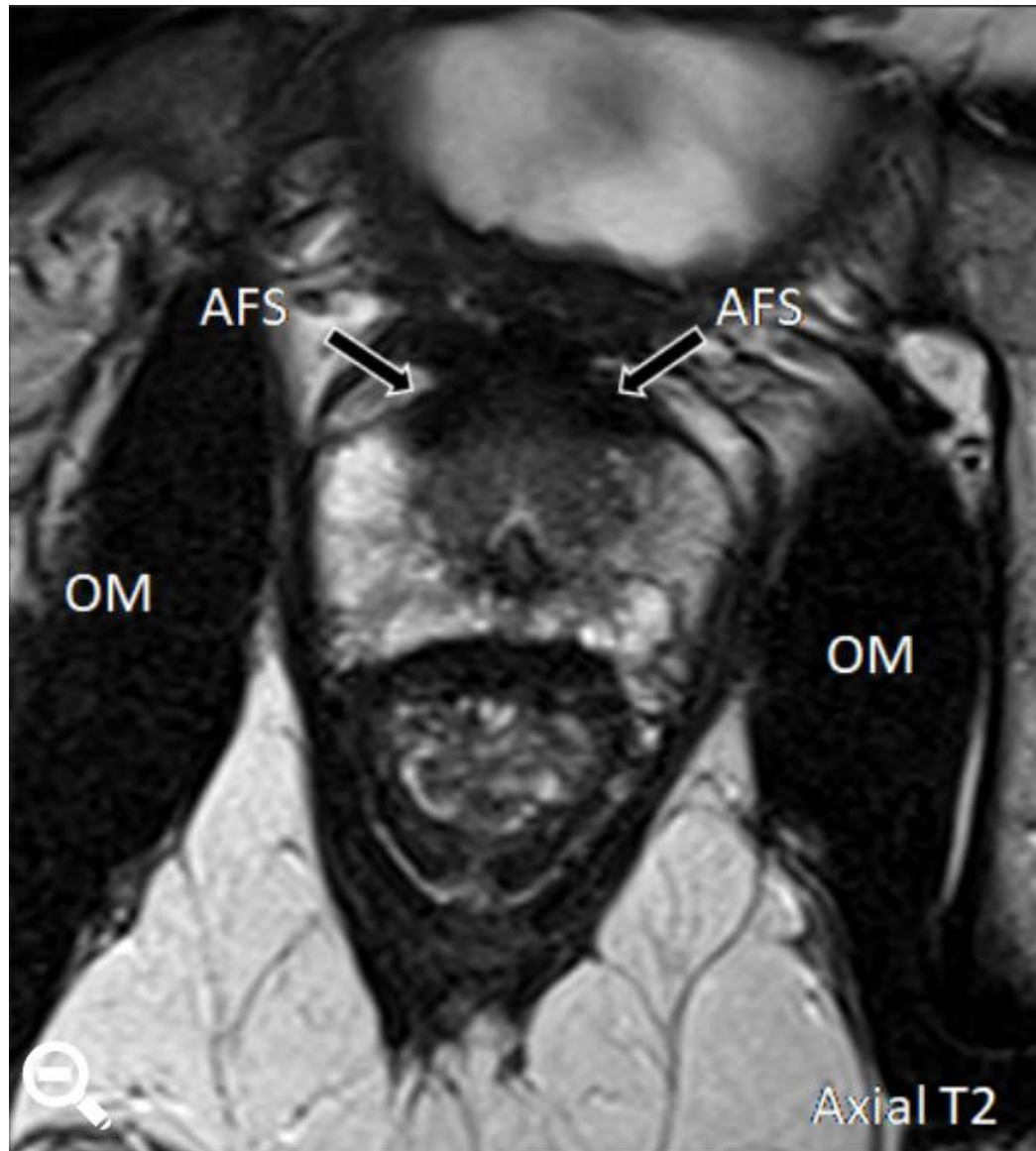


AFS example 2



The AFS can be thicker in some patients, especially in those without significant TZ hypertrophy

AFS example 2



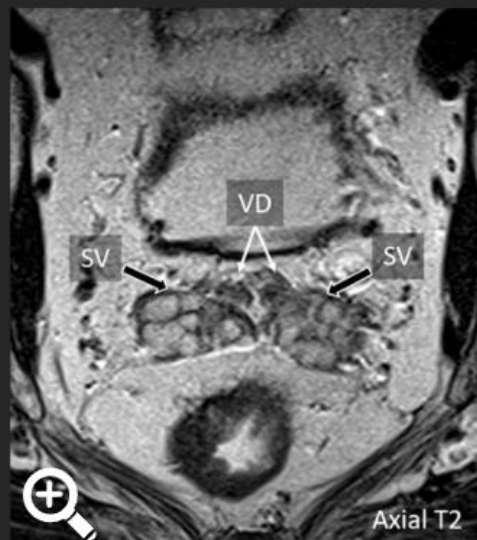
AFS example 2



Seminal Vesicles (SV)

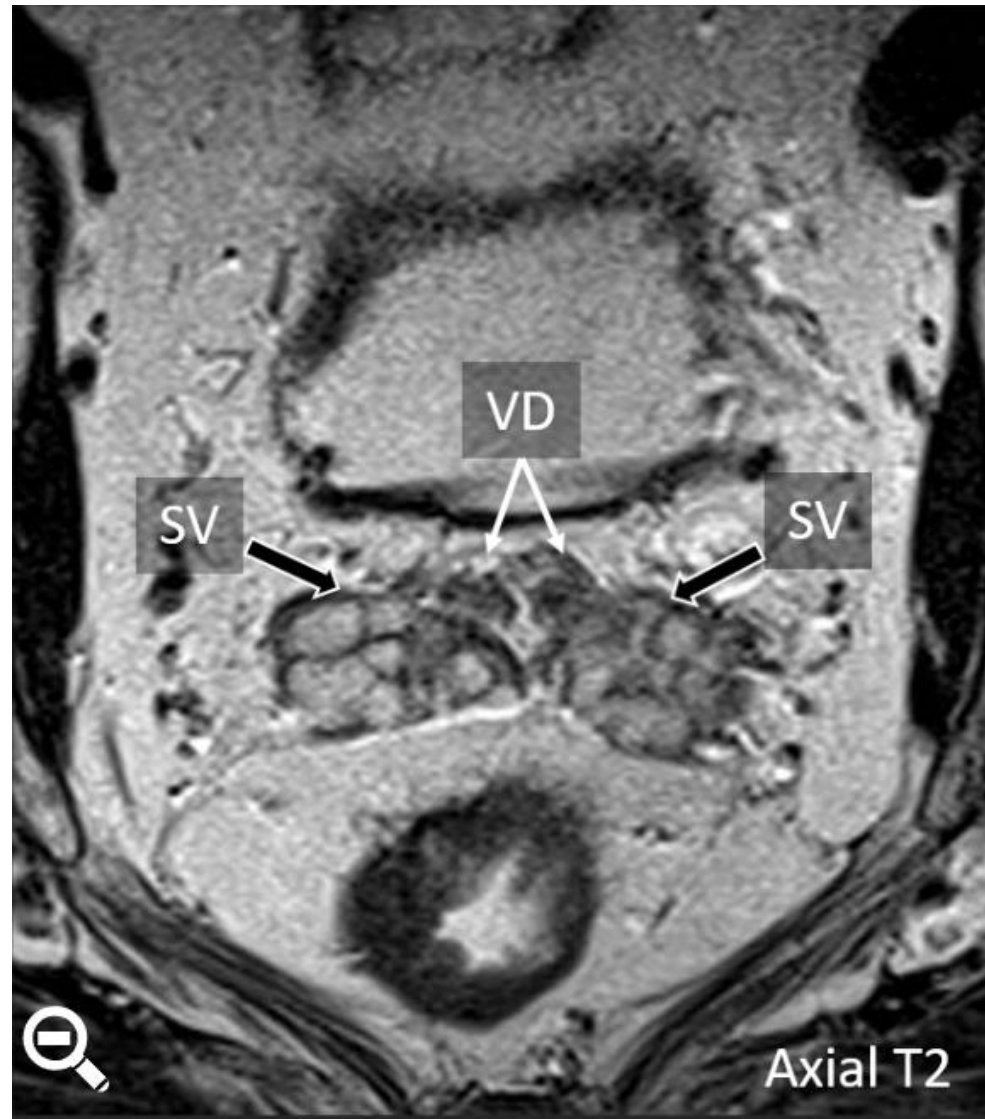
12% Completed

- The seminal vesicles (SV) are located posterior to the bladder and superior to the prostate gland.
- When distended with seminal fluid, the SV demonstrate high signal on T2WI.
- The SV join the ipsilateral vas deferens (VD) to form the ejaculatory duct (ED) at the base of the prostate.



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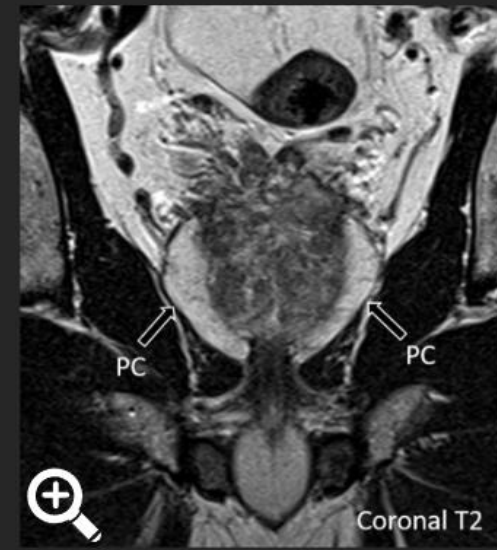


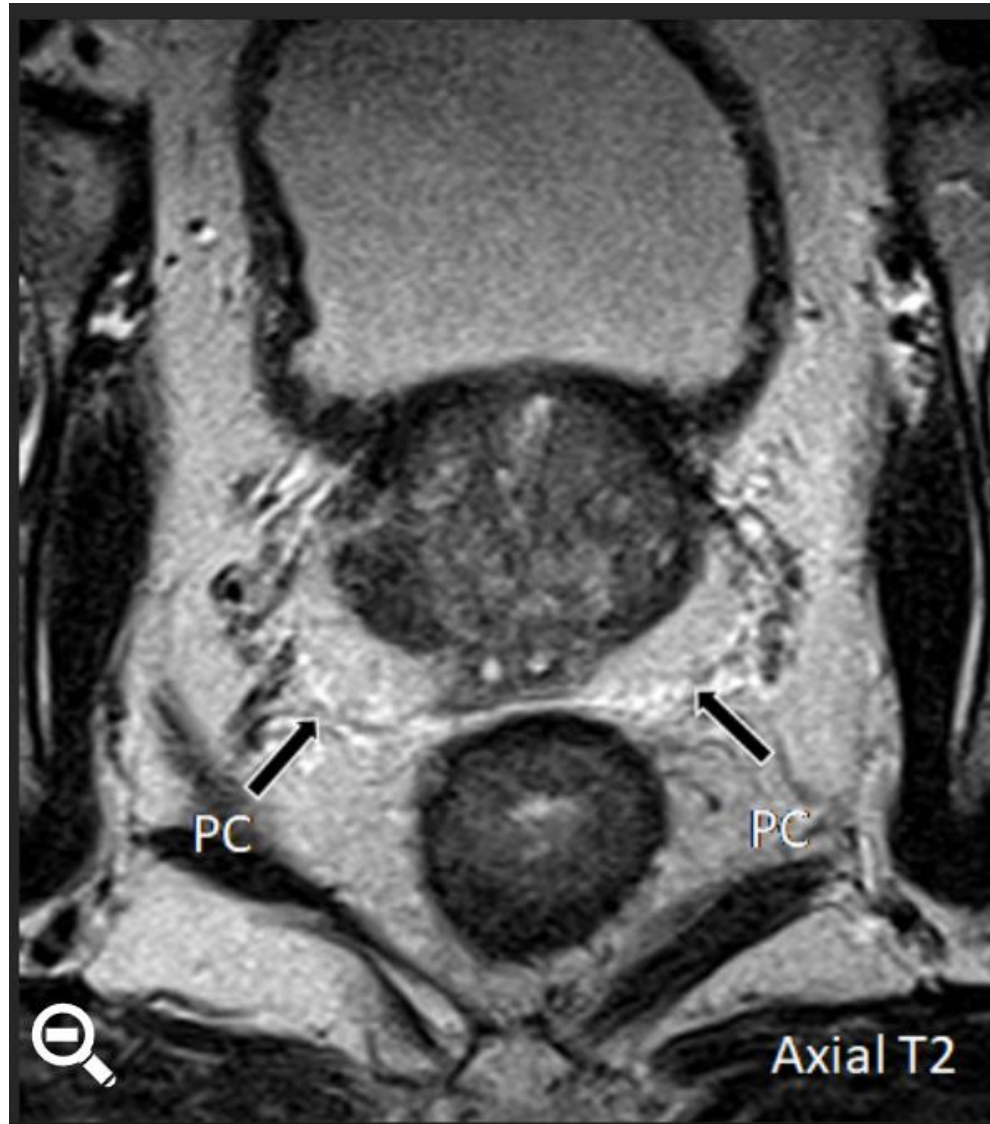


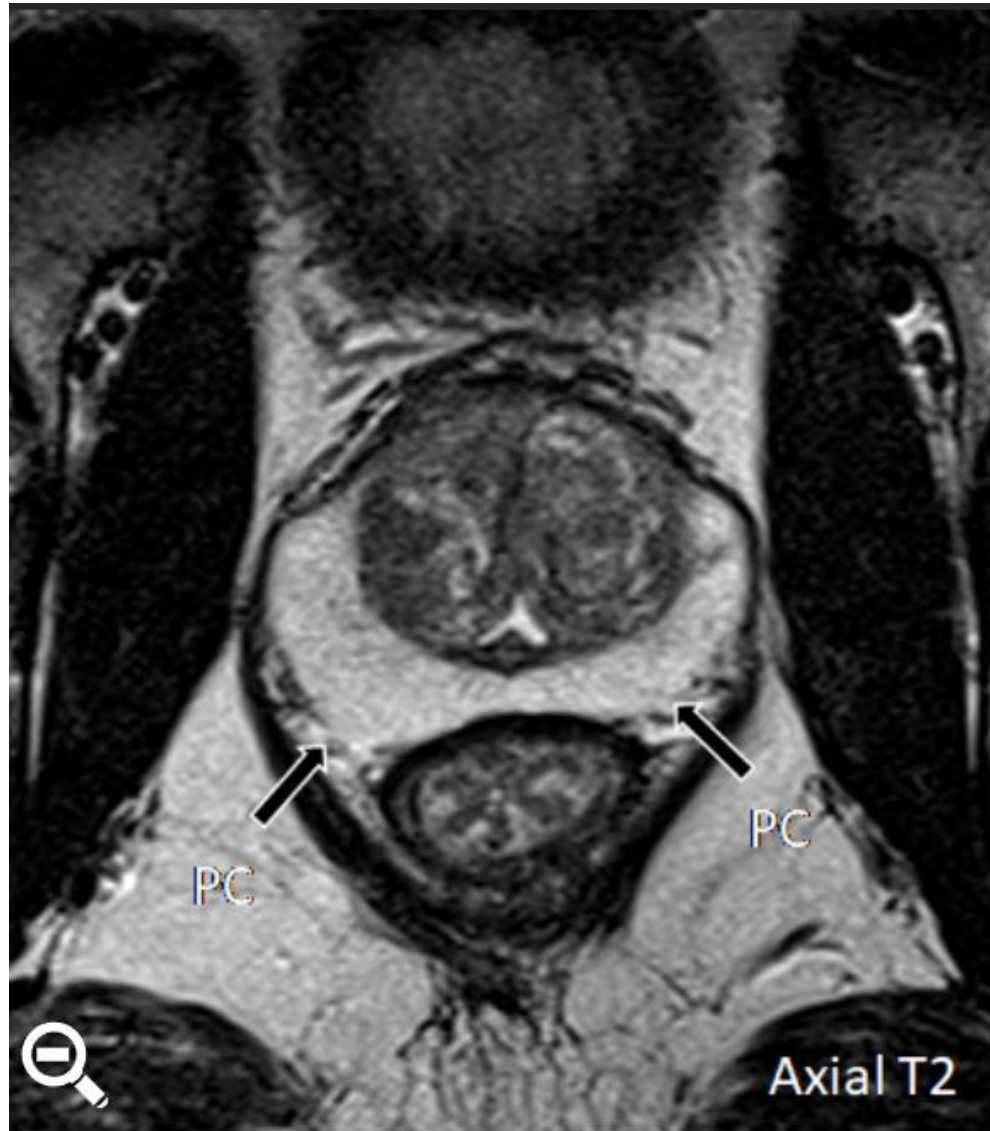


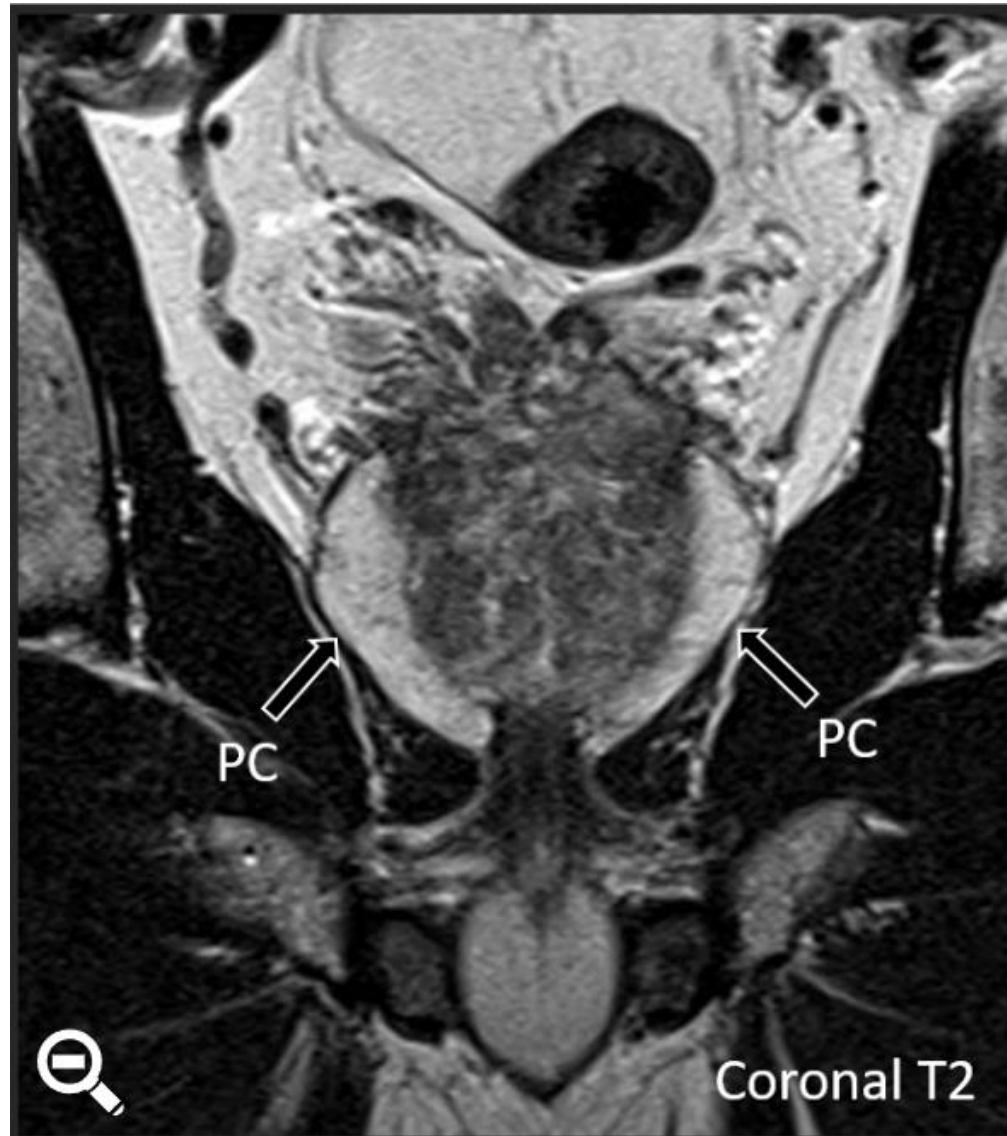
Prostate "Capsule"

- The prostate "capsule" (PC) is a thin, faint hypointense rim that partially surrounds the prostate on T2WI.
- PC is incomplete anteriorly and apically.
- It contains an outer band of concentric fibromuscular tissue that is inseparable from prostatic stroma (hence not a true capsule).
- The PC serves as an important landmark for assessment of extraprostatic extension of cancer.



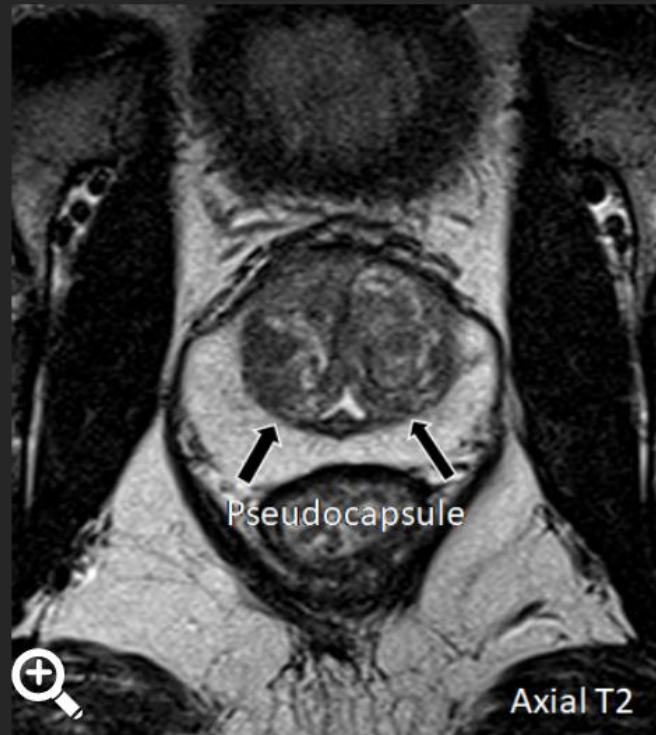






Prostate Pseudocapsule

- The prostatic pseudocapsule (also referred to as the “surgical capsule”) on T2WI is a thin, dark rim at the interface of the TZ with the PZ. There is no true capsule in this location at histological evaluation, and this appearance is due to compressed prostate tissue.

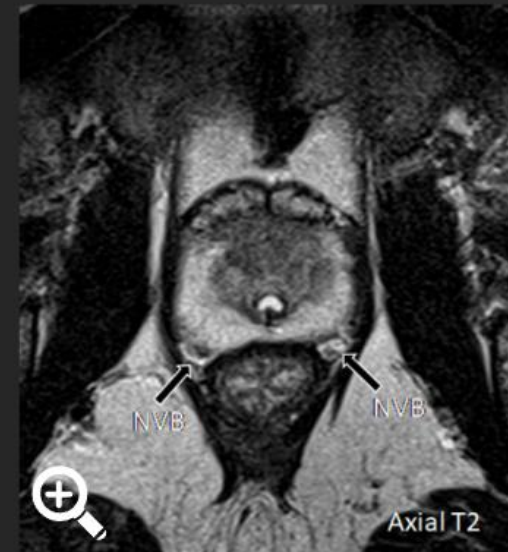


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Neurovascular Bundle (NVB)

- Nerves that supply the corpora cavernosa are intimately associated with arterial branches from the inferior vesicle artery and accompanying veins that course posterolateral at 5 and 7 o'clock to the prostate bilaterally, and together they constitute the neurovascular bundles. At the apex and base, small nerve branches surround the prostate periphery and penetrate through the capsule, a potential route for extraprostatic extension (EPE) of cancer.



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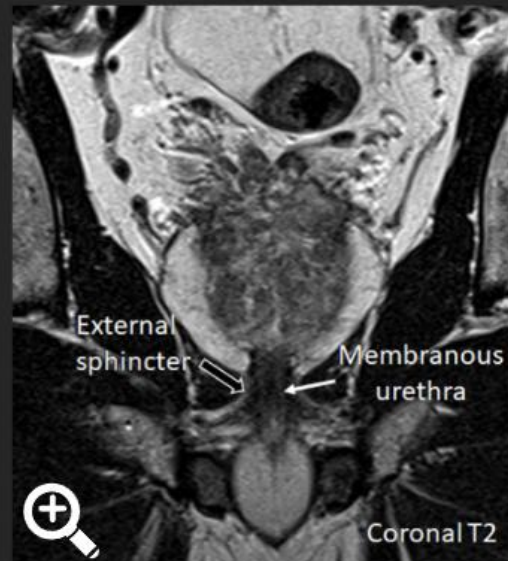
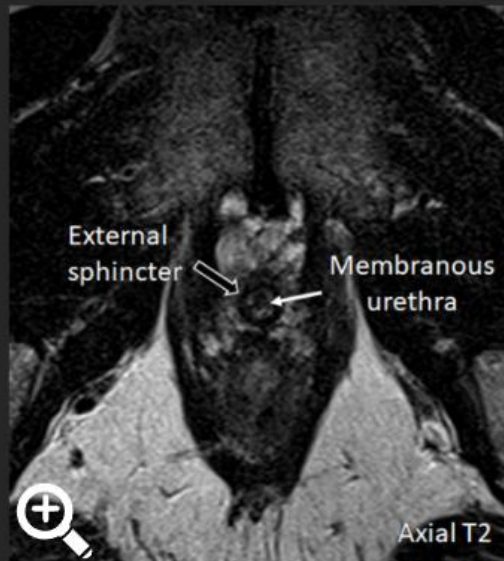


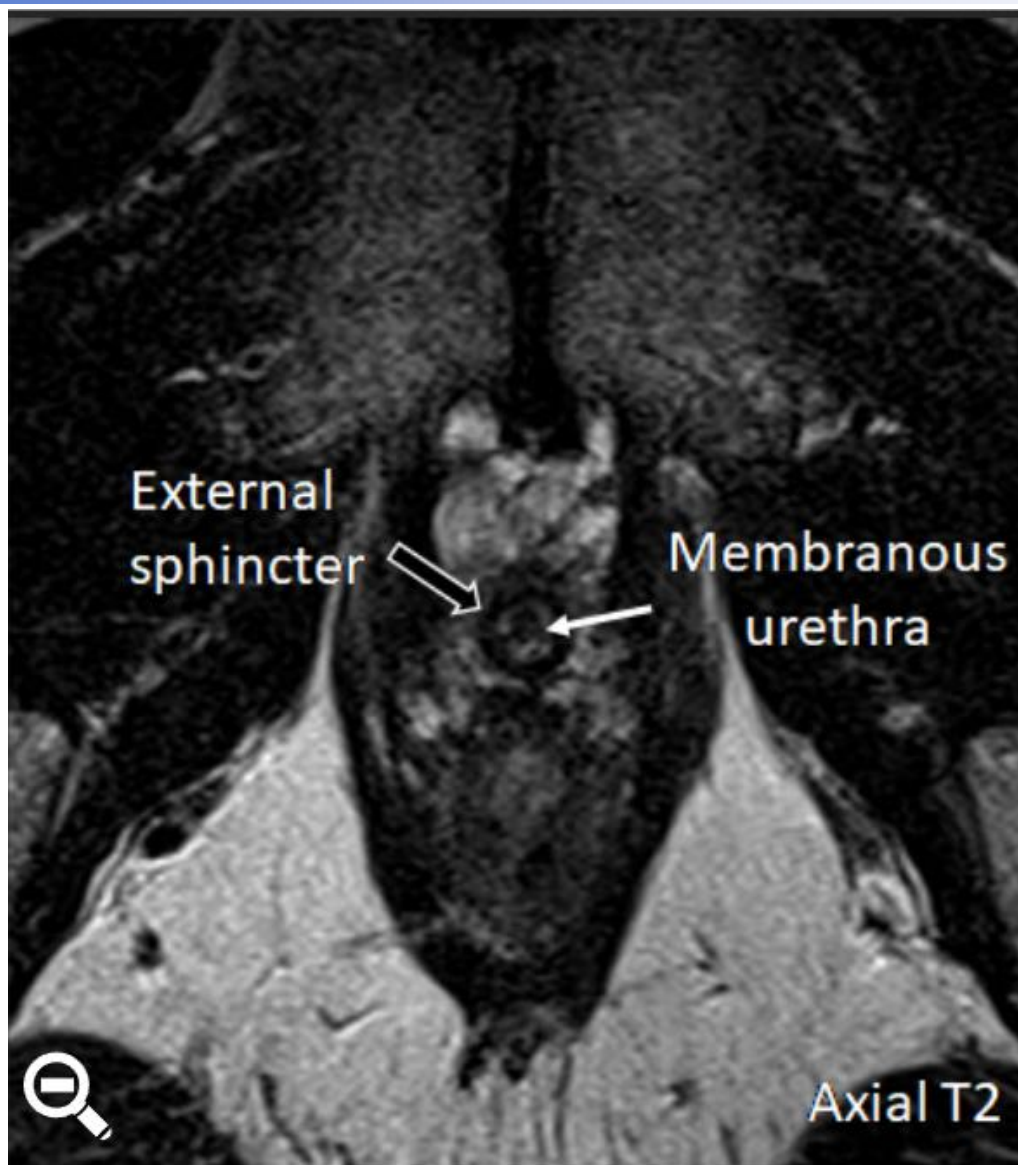


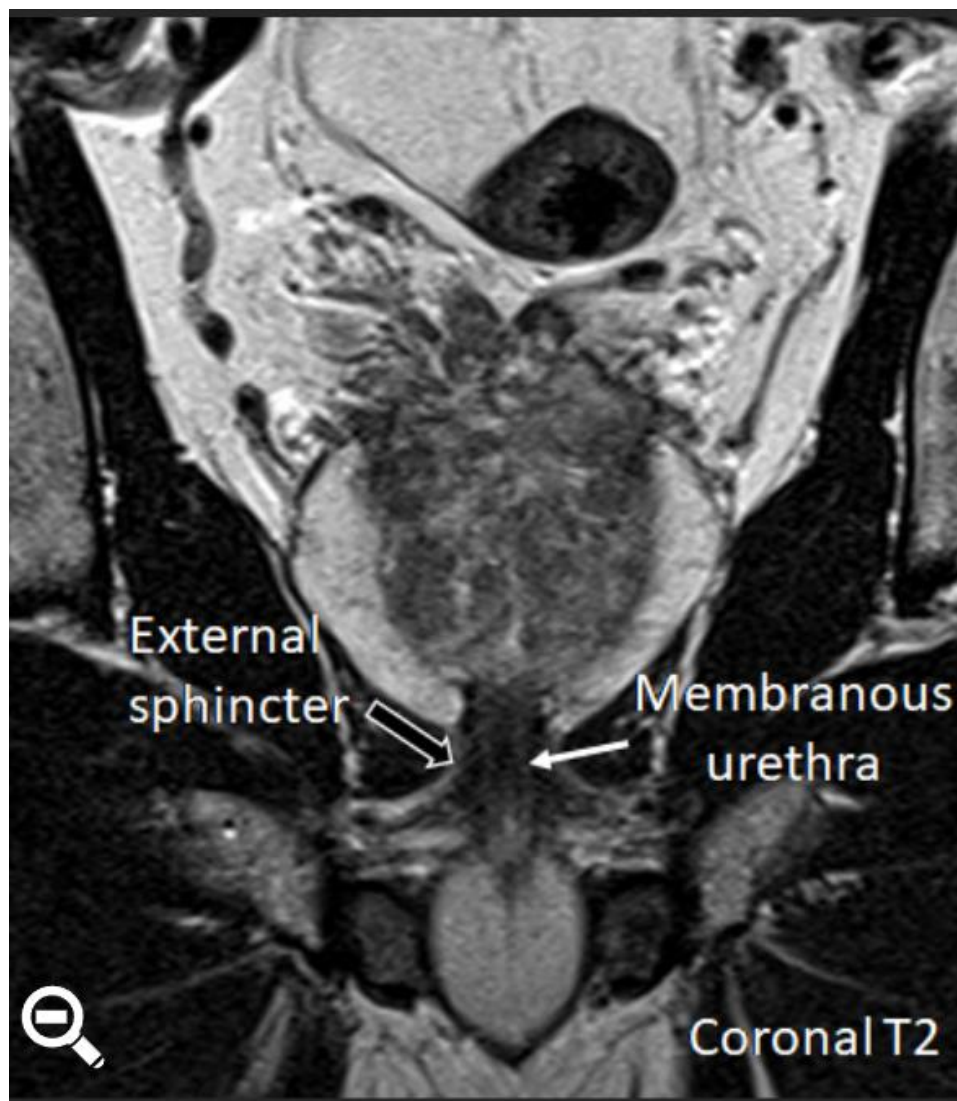


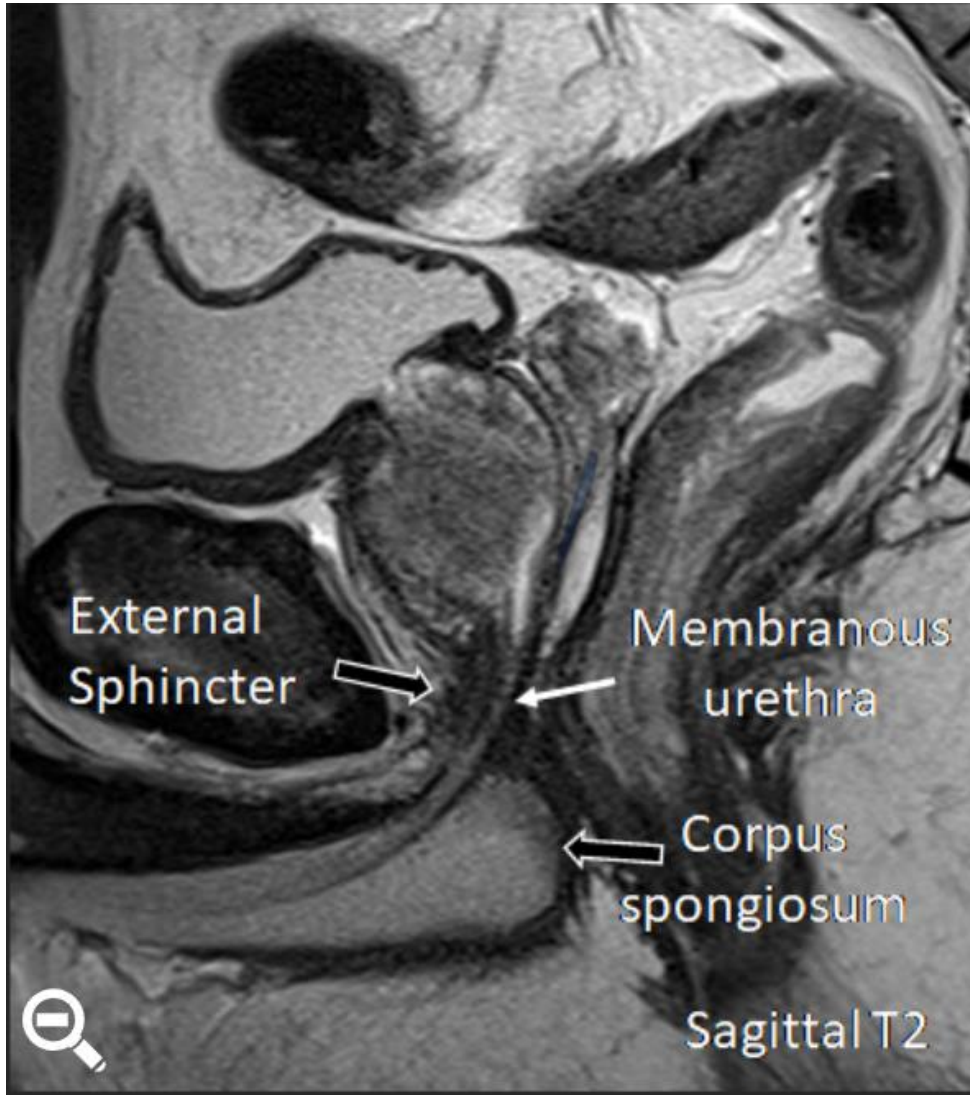
Membranous Urethra and External Sphincter

- The membranous segment of the urethra is located between the apex of the prostate and the bulb of the corpus spongiosum, extending through the urogenital diaphragm.
- The external sphincter surrounds the whole length of the membranous portion of the urethra and is enclosed in the fascia of the urogenital diaphragm.





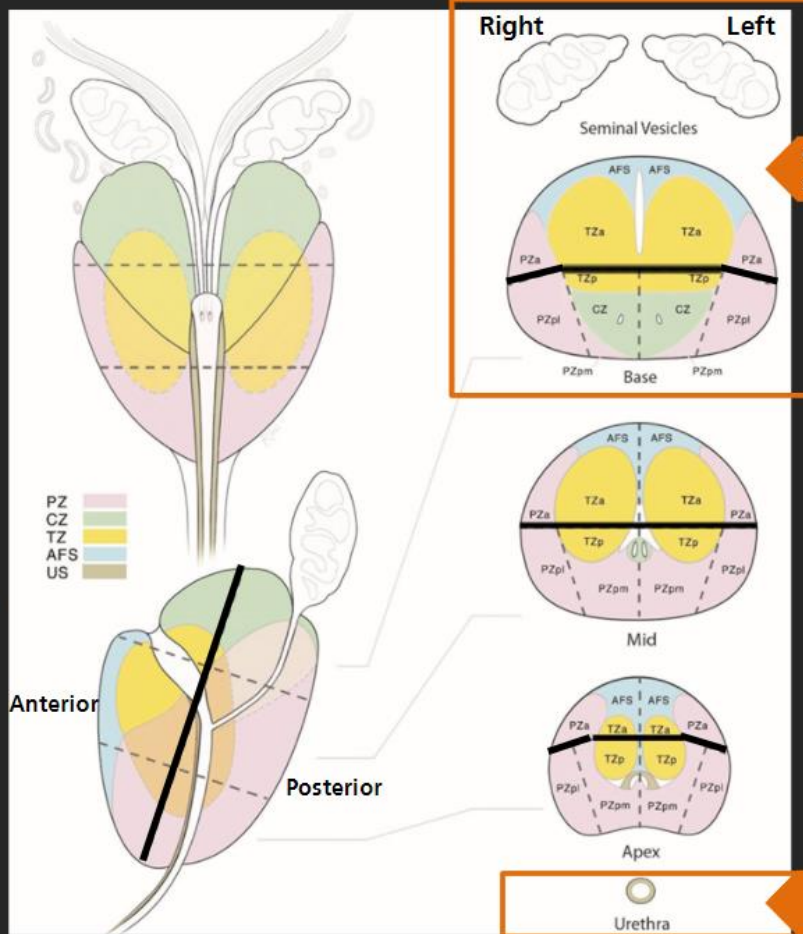




The Sector Map

- The 4 histological zones of the prostate are divided into sectors to facilitate the precise localization of findings described in MRI reports and to help guide MR-targeted biopsies and therapies.
- The sector map can also be used as a roadmap for surgical dissection at the time of radical prostatectomy and as a visual aid for discussions with patients about biopsy and treatment options.
- The prostate is divided into right/left on axial sections by a vertical line drawn through the center (indicated by the prostatic urethra), and into anterior/posterior by a horizontal line through the middle of the gland (black solid line in the diagram).
- A total of 41 sectors are represented in the map.

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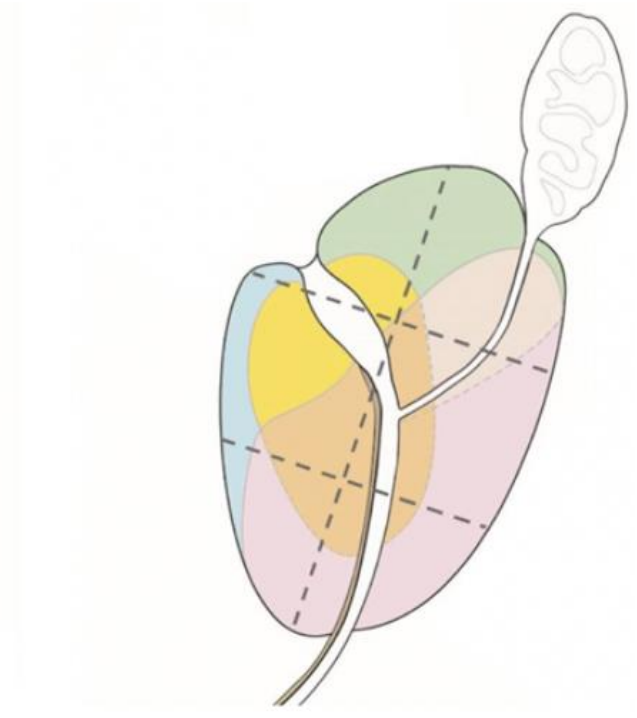
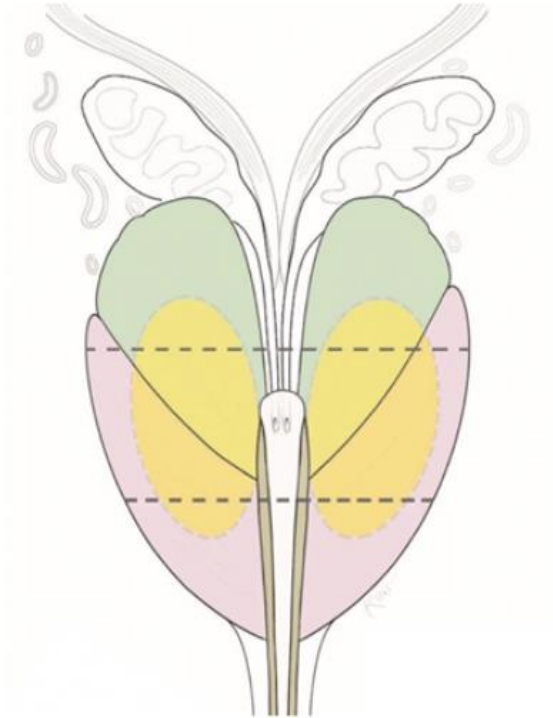
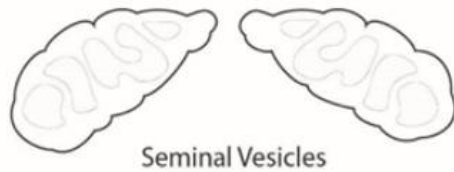


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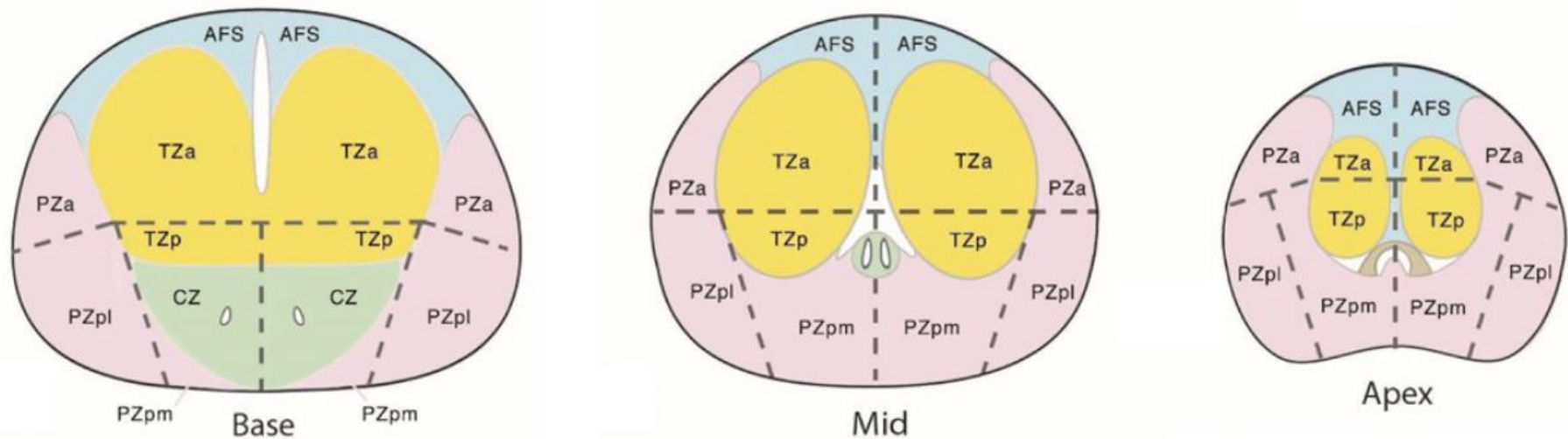
Select the different zones to see more

Select the urethra to see more

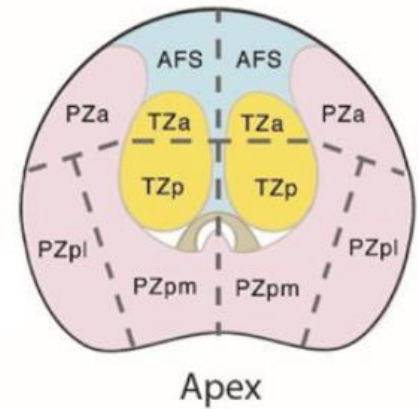
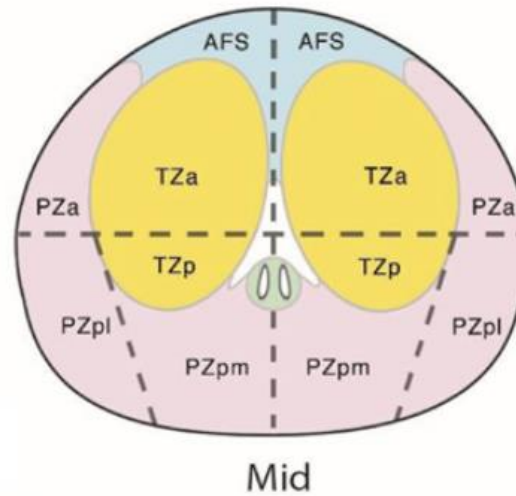
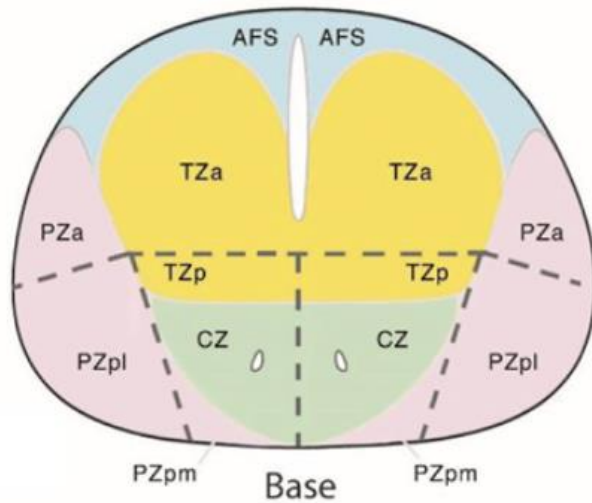
Each SV is represented as right and left sectors (2 sectors).



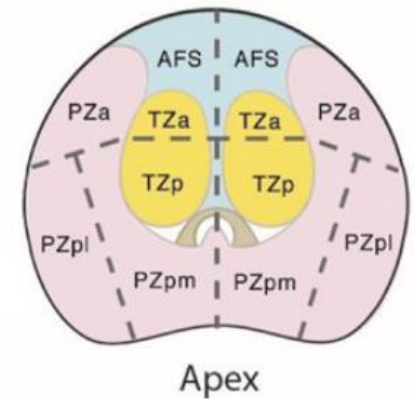
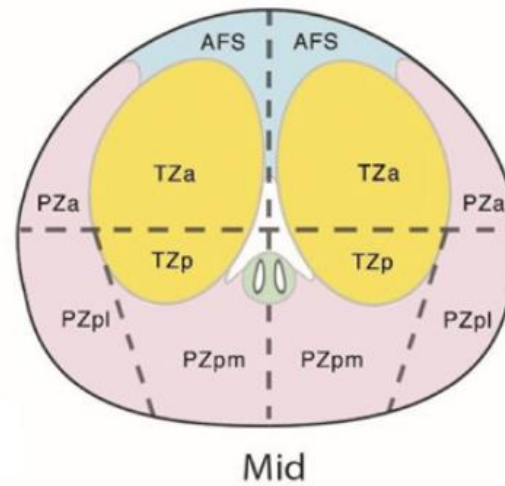
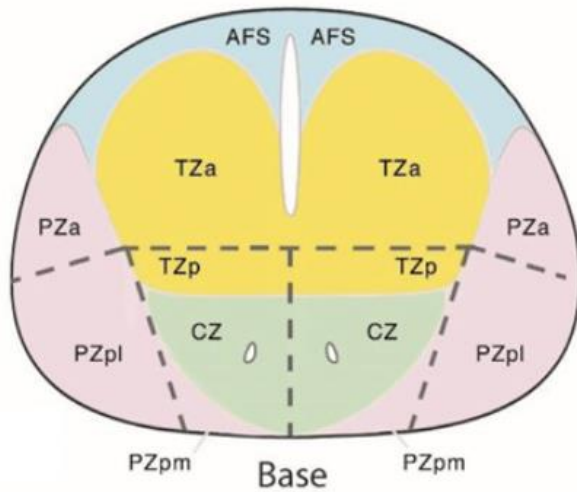
The TZ is divided into anterior (TZa) and posterior (TZp) sectors at the apex, mid gland and base (12 sectors).



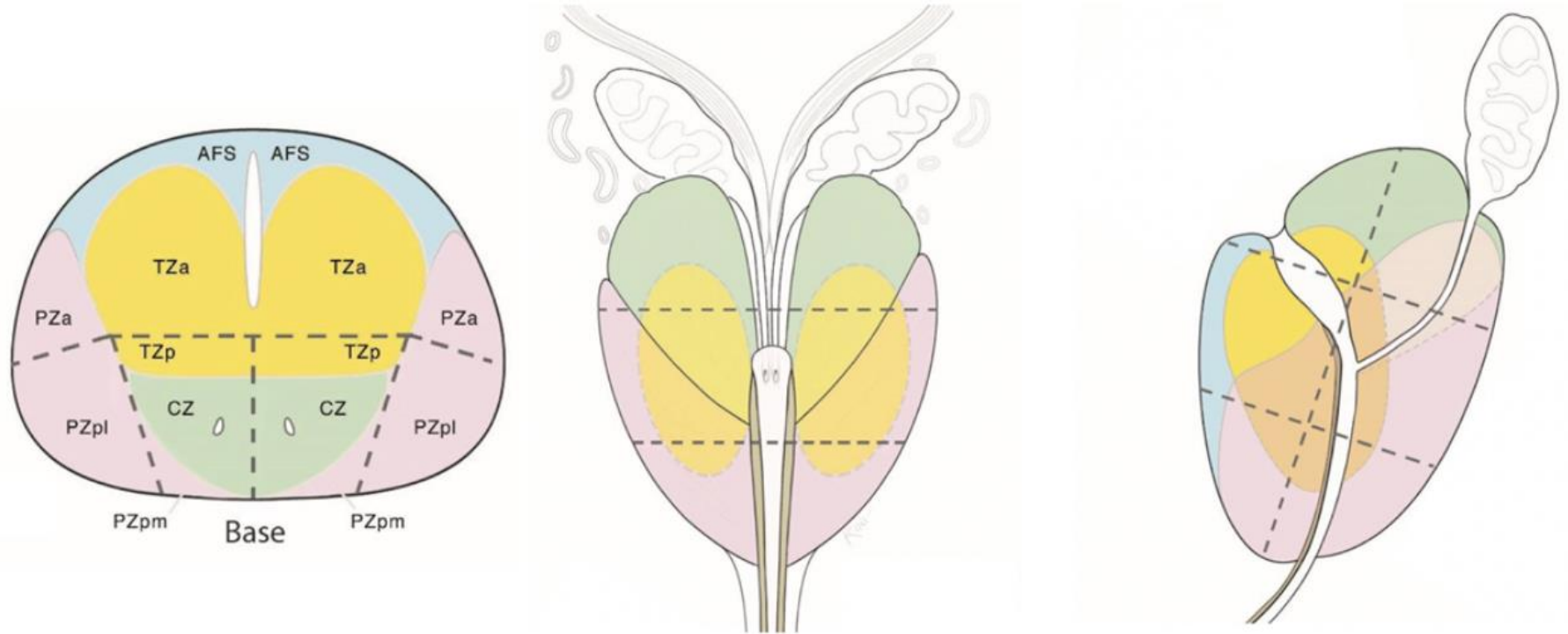
The PZ is divided into posteromedial (PZpm), postrolateral (PZpl) and anterior (PZa) sectors at the apex, mid gland and base (18 sectors).



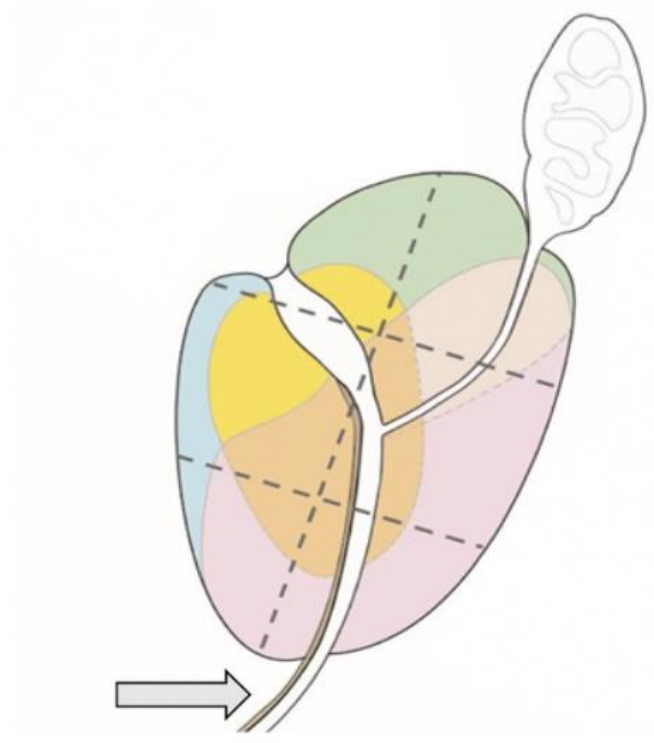
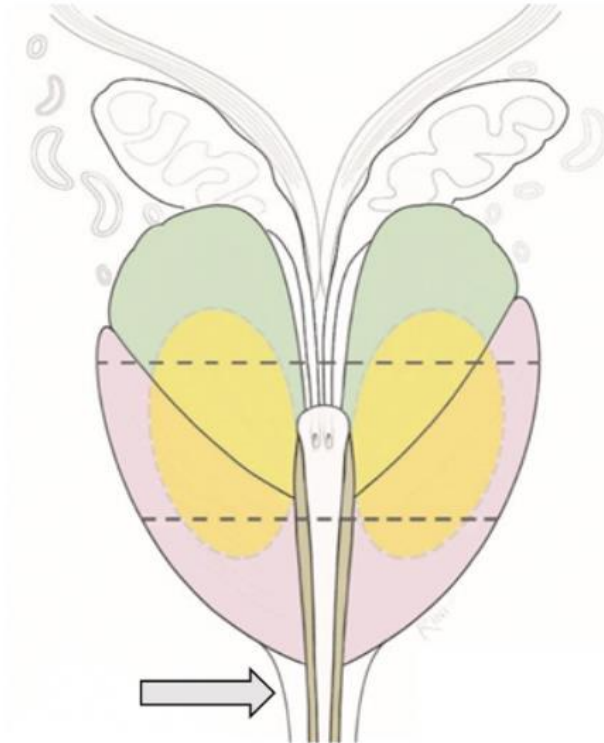
The AFS is divided into right and left sectors at the apex, mid gland and base (6 sectors).

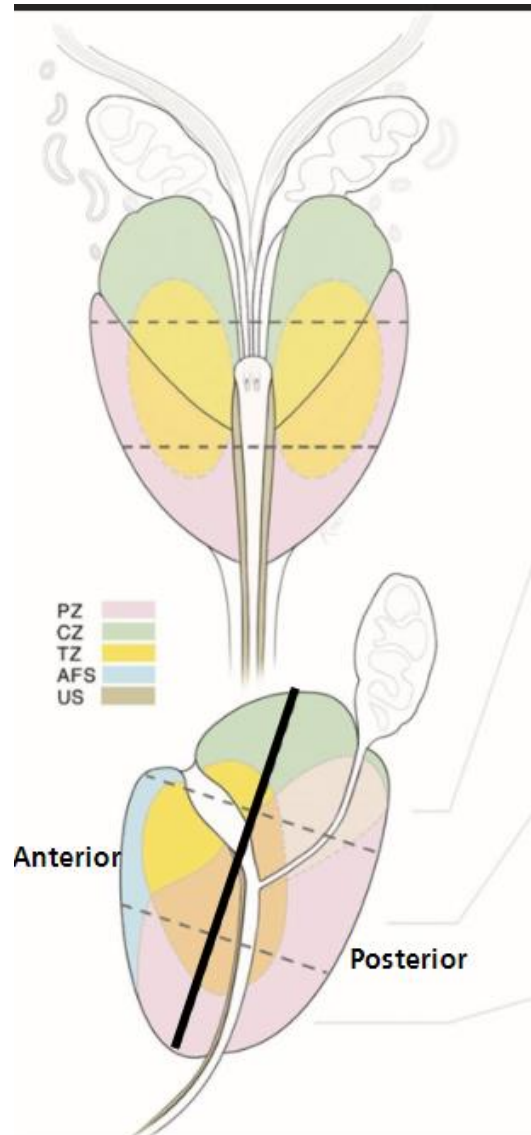


The CZ is divided into right and left sectors (2 sectors).



The membranous urethra is represented by one sector.





In which zone most prostate cancers arise?

A. Peripheral zone

B. Transition zone

C. Central zone

D. Anterior fibromuscular stroma

Submit

Question 1 of 5



Correct

75-80% of the cancers develop in the PZ.

A. Peripheral zone

Continue



In which zone benign prostatic hyperplasia occurs?

A. Peripheral zone

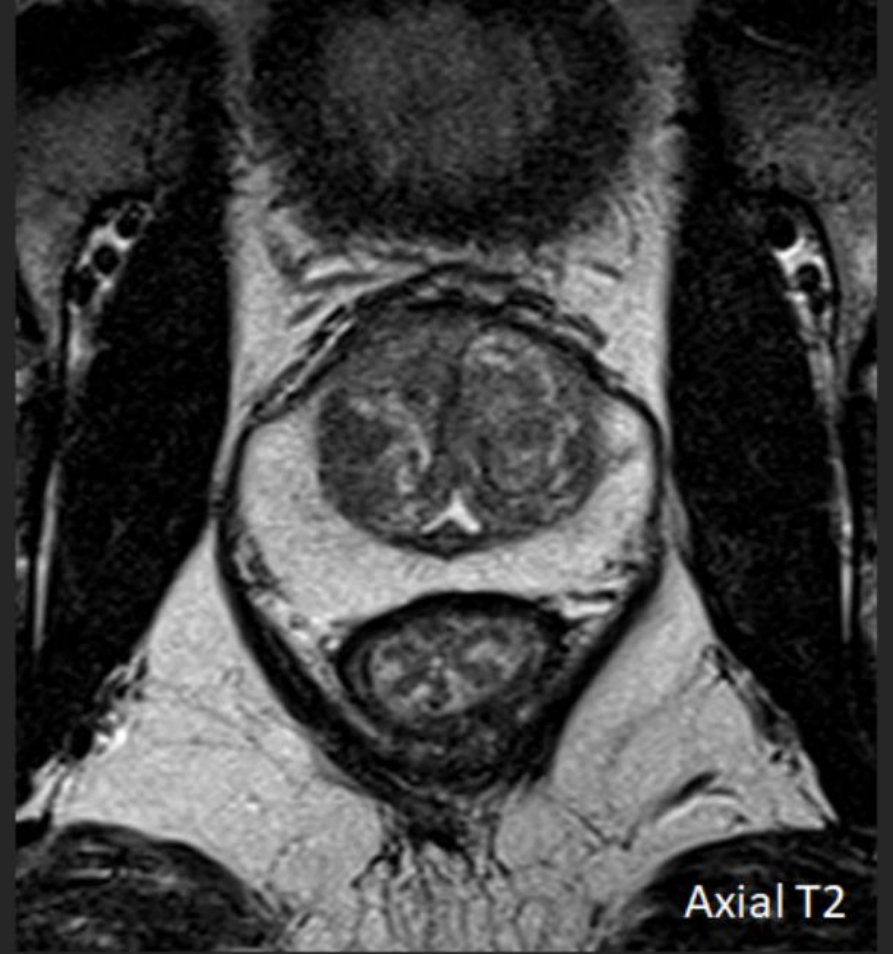
B. Transition zone

C. Central zone

D. Anterior fibromuscular stroma

Submit

Question 2 of 5



Correct

That's right! The answer is

b. Transition zone

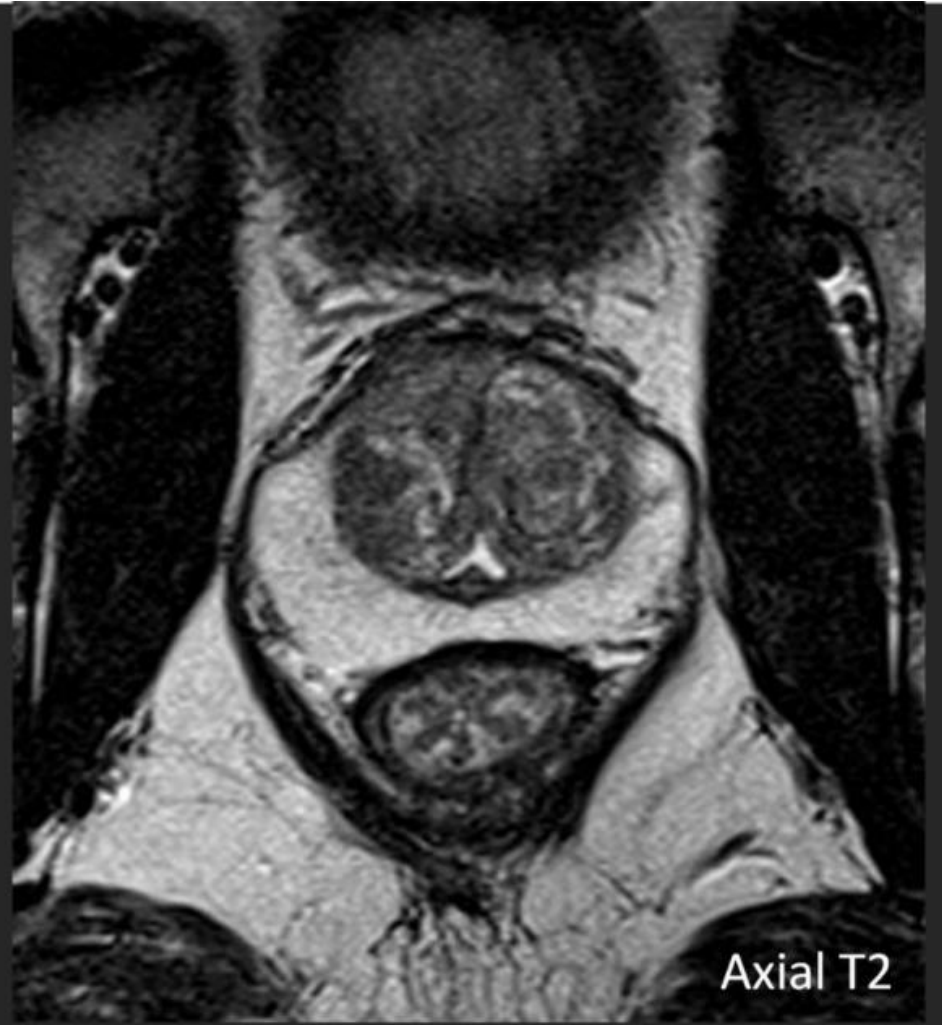
Explanation: Benign prostatic hyperplasia is a prevalent condition that occurs with aging and results from enlargement of the tissue in the transition zone.

B. Transition zone

Continue



Click on the right neurovascular bundle.



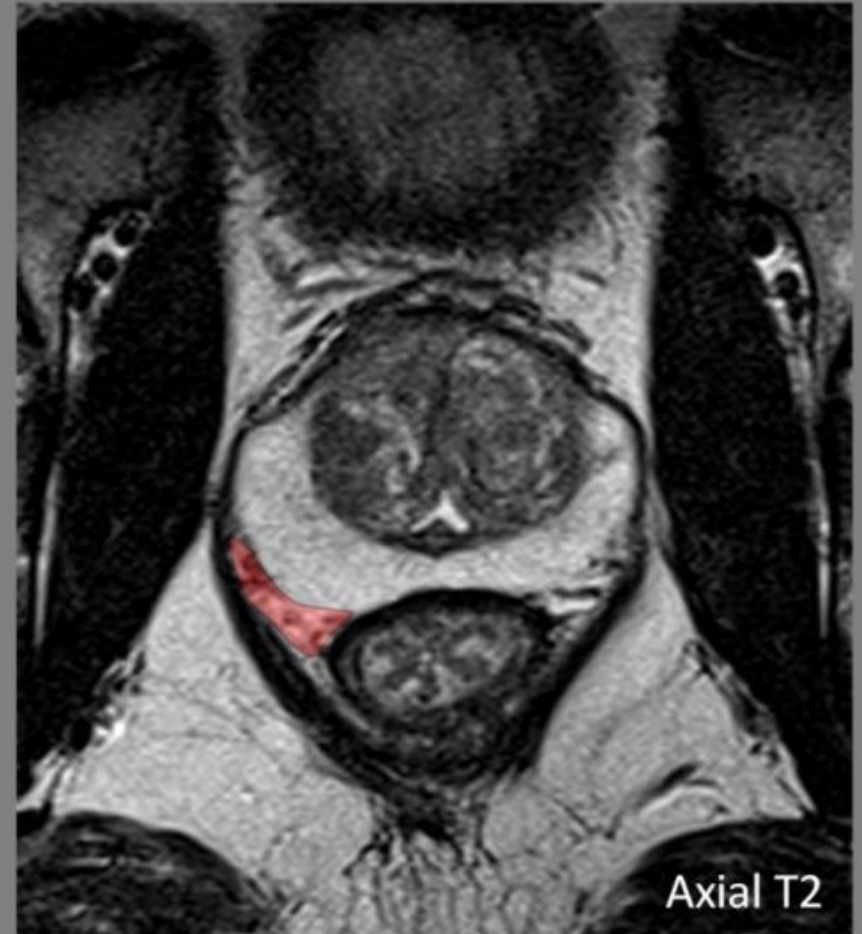
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Question 3 of 5

Correct

That's right! Nerves that supply the corpora cavernosa along with arterial branches from the inferior vesicle artery and accompanying veins course posterolateral at 5 and 7 o'clock to the prostate bilaterally, and together they constitute the neurovascular bundles.

Continue



What is the layer of tissue indicated by the arrows on Axial T2 image?

- A. Prostate "capsule"
- B. Prostate pseudocapsule
- C. Anterior glandular stroma
- D. Anterior fibromuscular stroma

Question 4 of 5

Submit

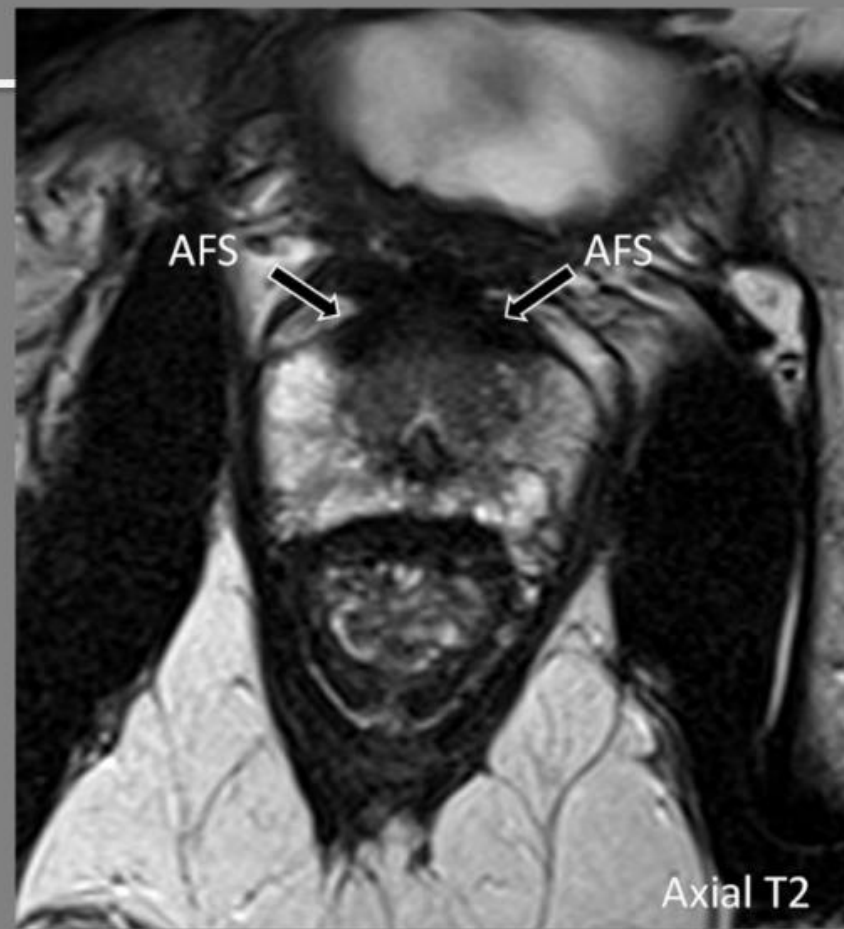


Correct

That's right! The answer is
d. Anterior fibromuscular stroma
Explanation: The anterior fibromuscular
stroma (AFS) is the layer of T2W
hypointense tissue in the anterior
prostate.

D. Anterior fibromuscular
stroma

Continue



Click on the Central Zone.



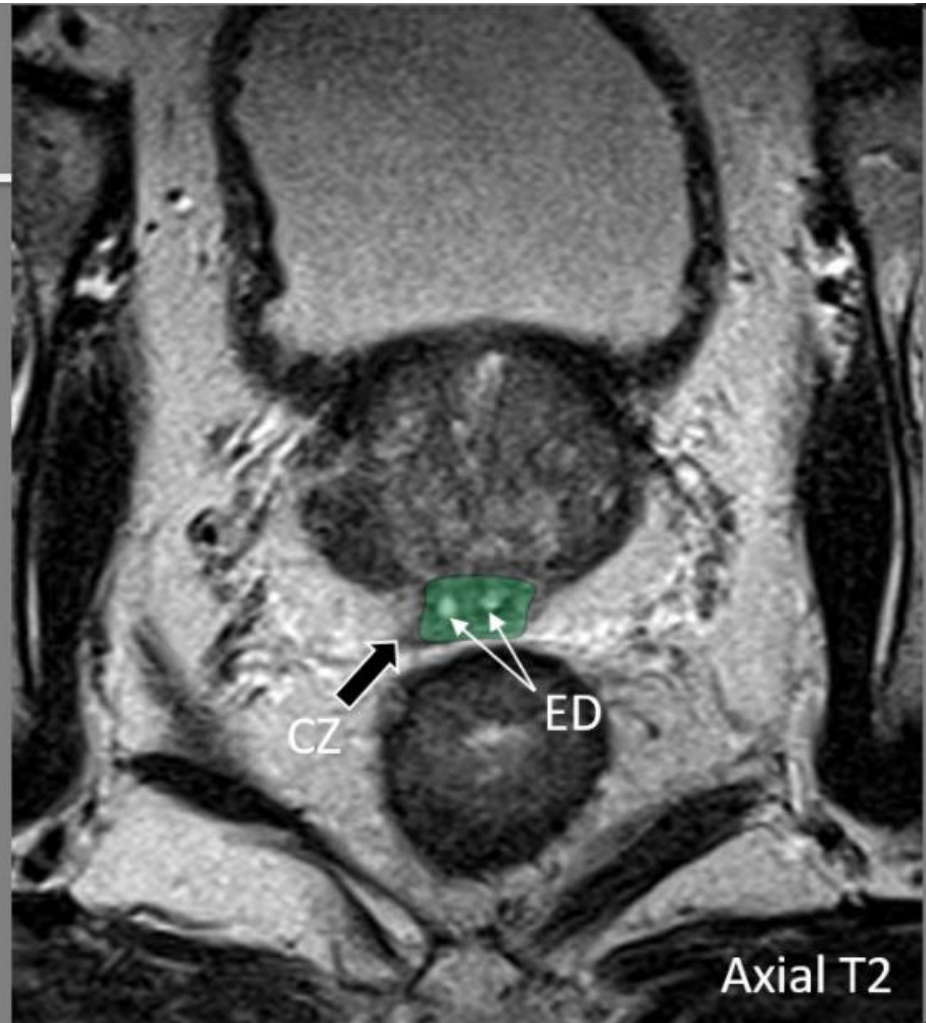
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Question 5 of 5

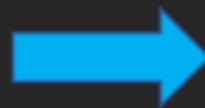
Correct

That's right! The central zone is a cone-shaped layer of tissue that surrounds the ejaculatory ducts (ED) at the base and mid gland.

[Return to Menu](#)



- PI-RADS uses 5 assessment categories to indicate the likelihood of the presence of clinically significant prostate cancer on mpMRI.
- PI-RADS defines clinically significant prostate cancer (csPCa) as tumor with a Gleason score $\geq 3 + 4$, and/or volume $\geq 0.5\text{cc}$, and/or invasive behavior (e.g. extraprostatic extension).
- The assignment of assessment categories to individual abnormalities is based on a combination of predefined features on T2WI, DWI and DCE, following a stepwise process.



Likelihood of Clinically Significant PCa

PI-RADS 1
Highly unlikely

PI-RADS 2
Unlikely

PI-RADS 3
Indeterminate

PI-RADS 4
Likely

PI-RADS 5
Highly likely

1. Once FOCAL* abnormalities are identified, their anatomical location is defined within the prostate zones.
2. Abnormalities are then individually scored on a 5-point scale based on their appearance on T2WI and on DWI/ADC.
3. The PI-RADS assessment category of a lesion is then determined based on the score assigned on the pulse sequence that is considered the dominant parameter for the location where the lesion is located.

*FOCAL – discrete and different from the background tissue.

Abnormality identified



Anatomical Localization

Likelihood of Clinically Significant PCa

PI-RADS 1
Highly unlikely

PI-RADS 2
unlikely

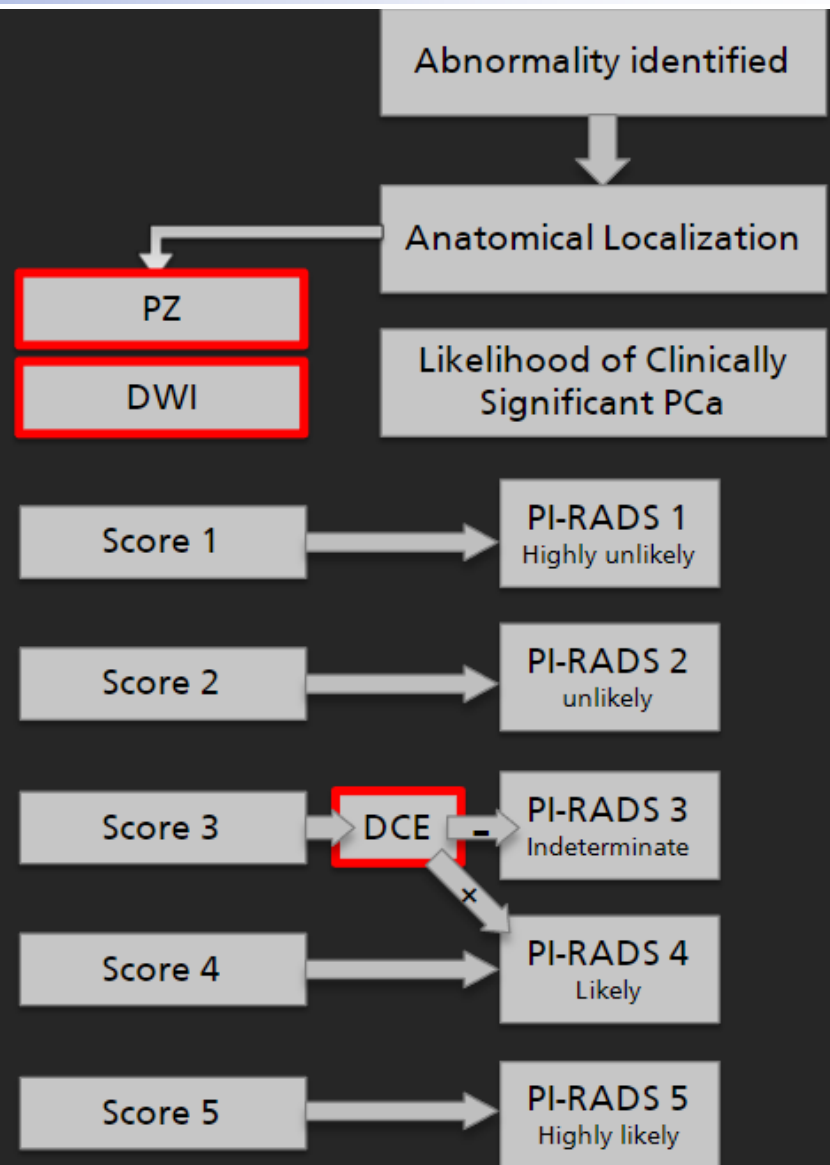
PI-RADS 3
Indeterminate

PI-RADS 4
Likely

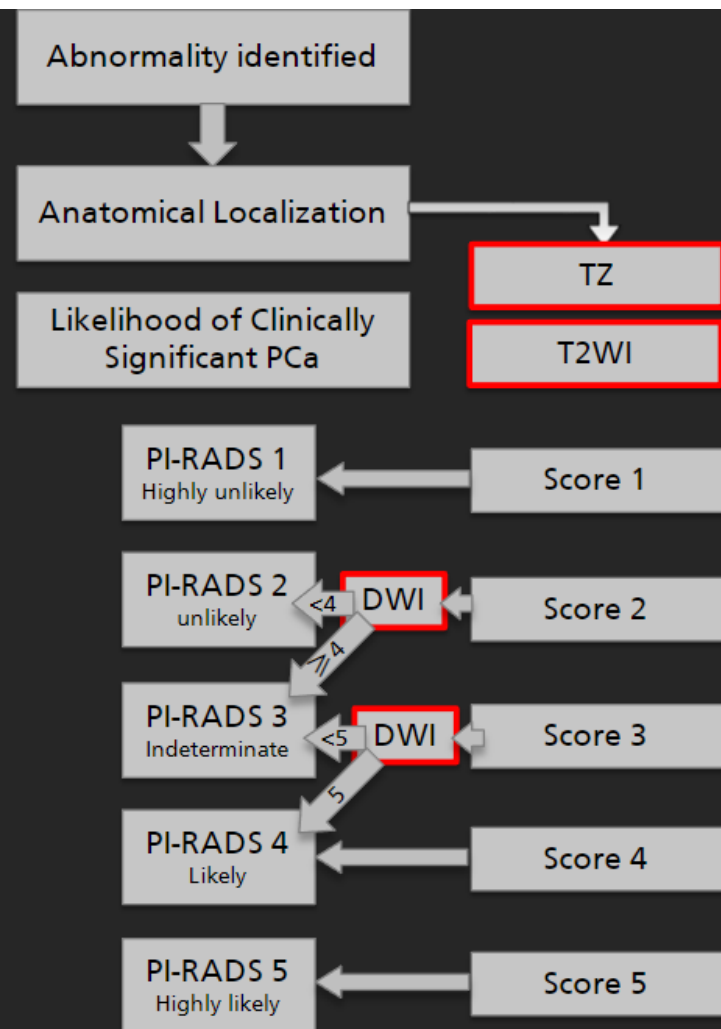
PI-RADS 5
Highly likely

Slide 2 of 20

- DWI is the dominant parameter for lesions in the PZ.
- DCE plays an ancillary role for categorization of PZ lesions considered equivocal based on DWI/ADC (i.e. DWI/ADC score 3).

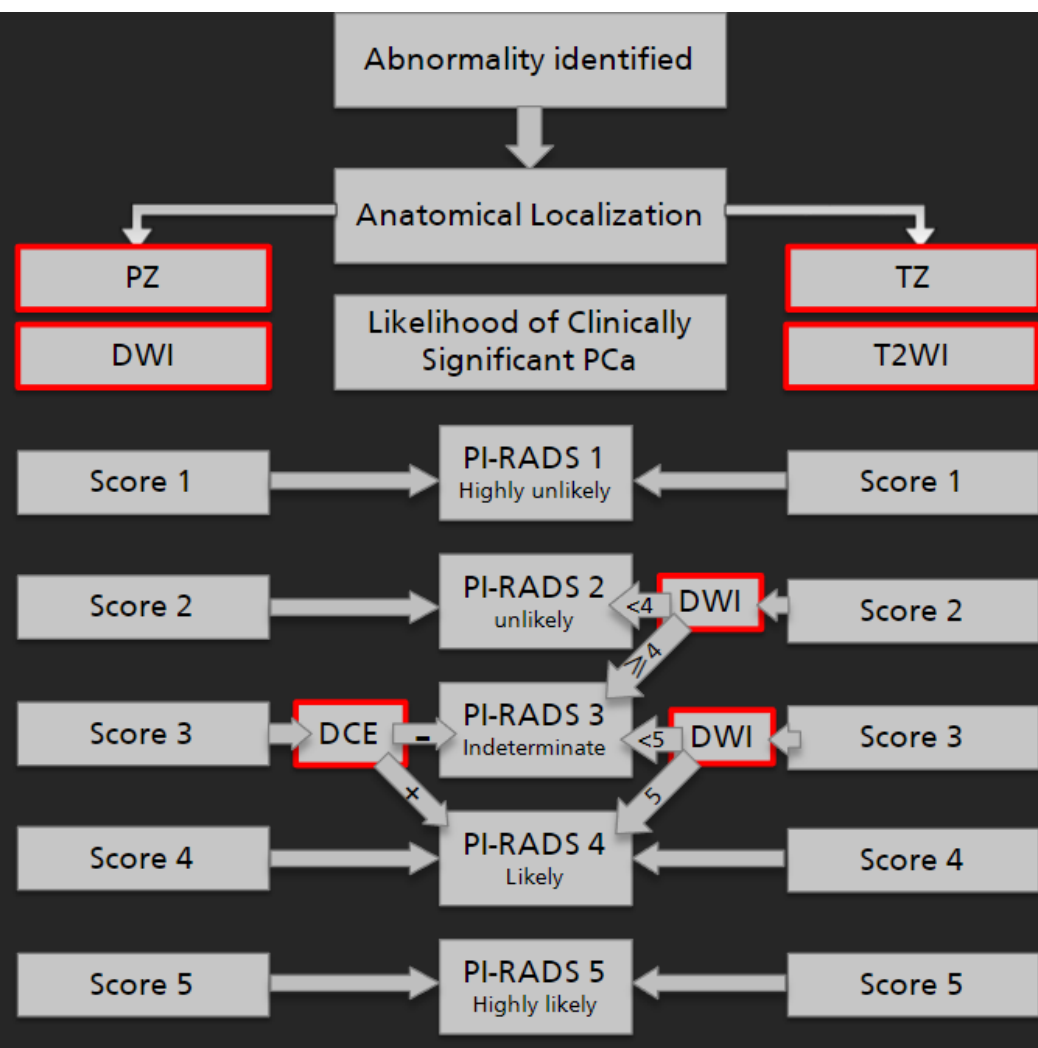


- T2WI is the dominant parameter for lesions located in the TZ.
- DWI has an ancillary role for categorization of TZ lesions that are considered atypical BPH nodules or areas in between nodules on T2WI (i.e. T2WI score 2), and lesions considered equivocal on T2WI (i.e. T2WI score 3).



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- Next, we will examine the image criteria for each zone.

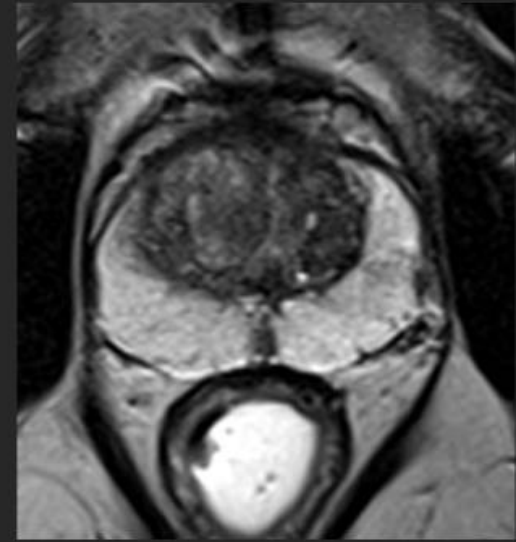


Slide 5 of 20

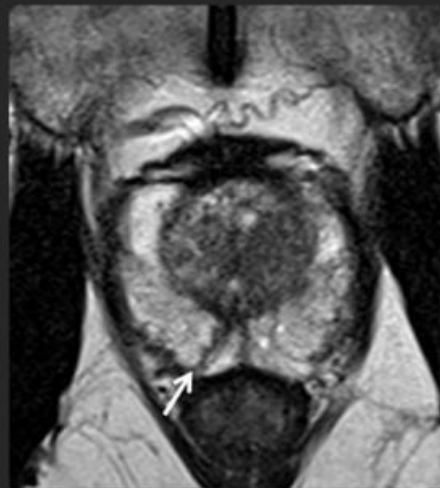
Select the Score number to see the examples

Score	Peripheral Zone T2W criteria
1	Uniform hyperintense signal intensity (normal)
2	Linear or wedge-shaped hypointensity or diffuse mild hypointensity, usually indistinct margin
3	Heterogeneous signal intensity or non-circumscribed, rounded, moderate hypointensity. Includes others that do not qualify as 2, 4, or 5
4	Circumscribed, homogenous moderate hypointense focus/mass confined to prostate and <1.5 cm in greatest dimension
5	Same as 4 but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior

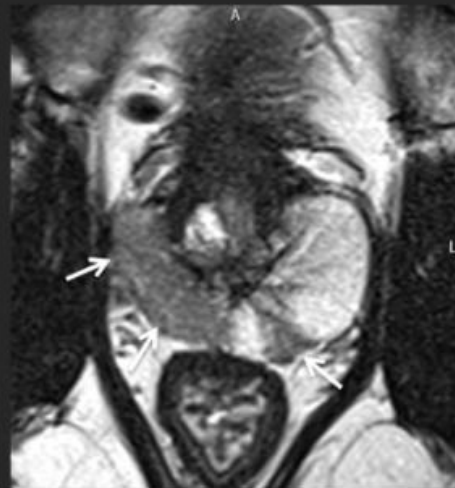
Score	Peripheral Zone T2W criteria
1	Uniform hyperintense signal intensity (normal)



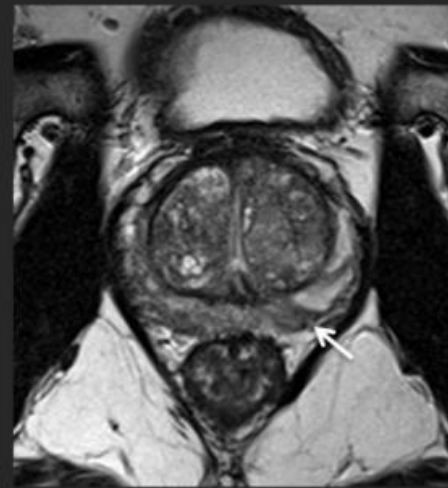
Score	Peripheral Zone T2W criteria
2	Linear or wedge-shaped hypointensity or diffuse mild hypointensity, usually indistinct margin



Linear



Lobar and wedge-shaped

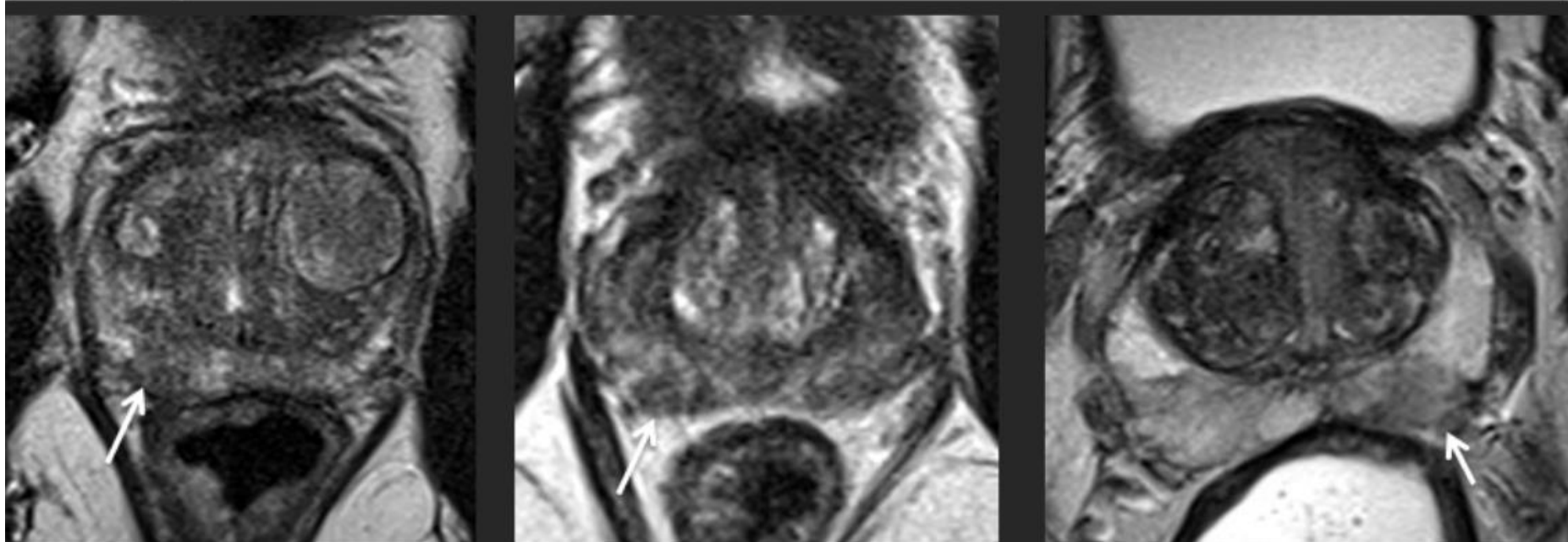


Linear and wedge-shaped

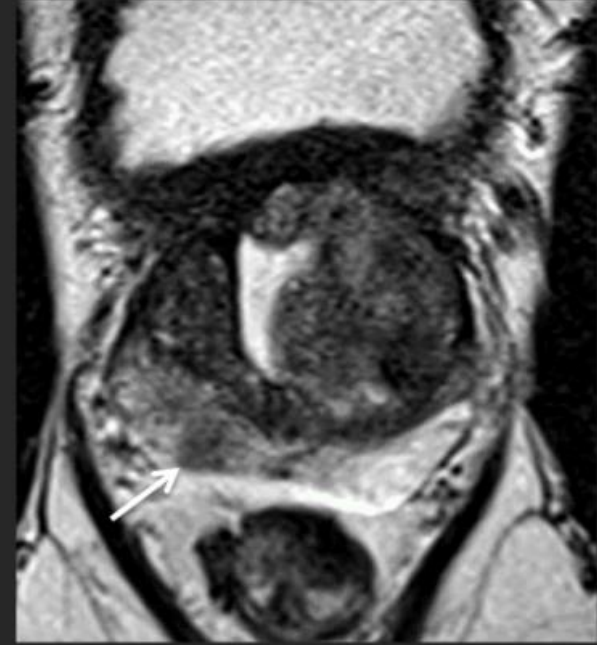
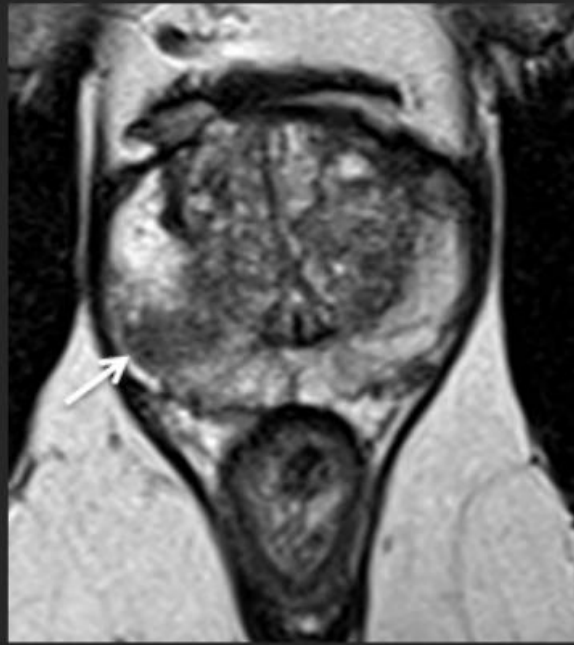


Diffuse

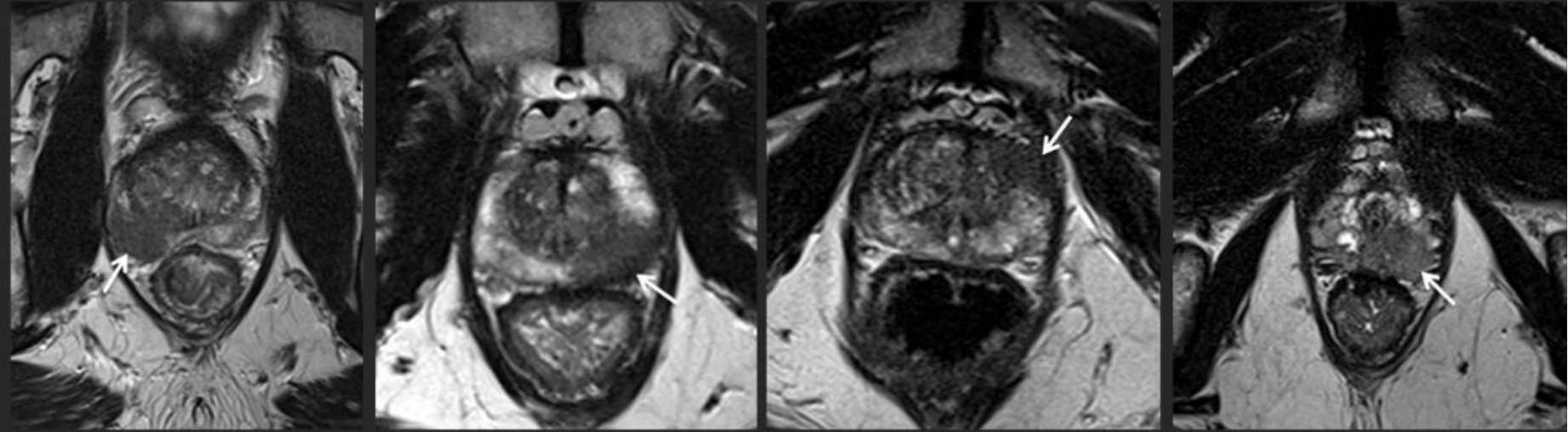
Score	Peripheral Zone T2W criteria
3	Heterogeneous signal intensity or non-circumscribed, rounded, moderate hypointensity. Includes others that do not qualify as 2, 4, or 5



Score	Peripheral Zone T2W criteria
4	Circumscribed, homogenous moderate hypointense focus/mass confined to prostate and <1.5 cm in greatest dimension

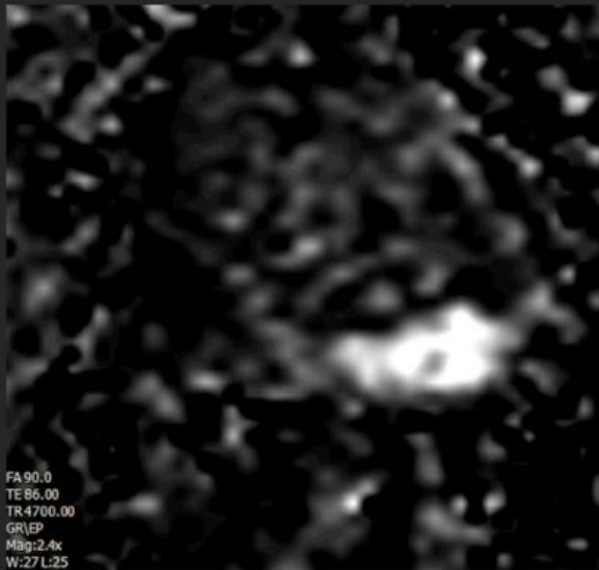


Score	Peripheral Zone T2W criteria
5	Same as 4 but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior



- In PI-RADS, the assessment of DWI and ADC map is based on qualitative criteria.
- The same criteria apply to both PZ and TZ.
- DWI and ADC maps should be consistently viewed with the same contrast (window width and level) settings. They should be set to portray csPCa in a way that they appear markedly hyperintense on DWI and markedly hypointense on ADC maps.

[Click here to see more information](#)



Window W/L settings of 1400 are used in some practices, but this may not work for all scanners.

Play video to change window width and level (W/L) of the ADC map

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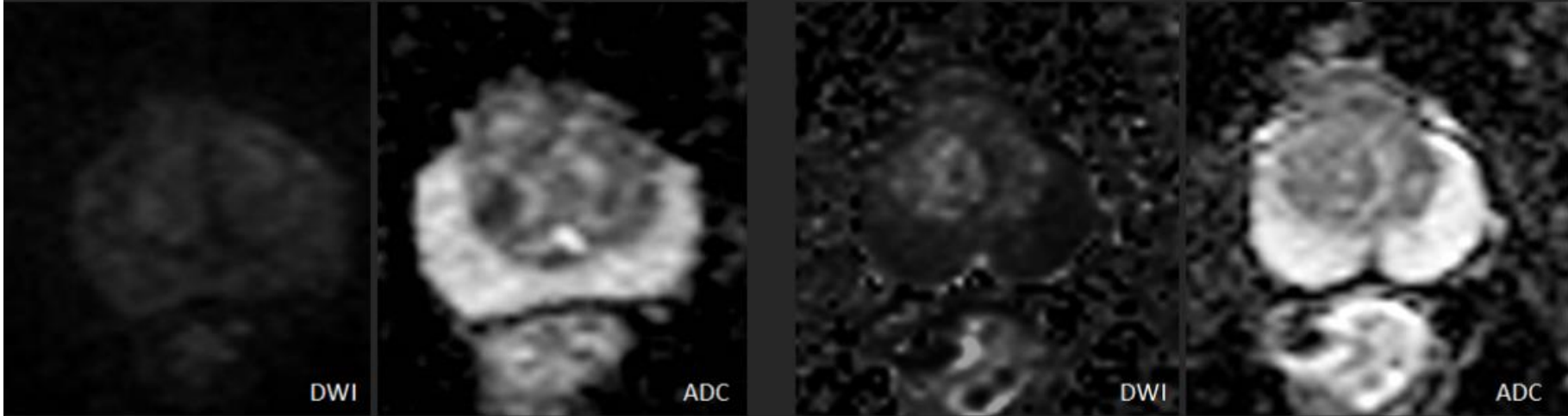
More Information

- The quantitative assessment ADC values have been reported to correlate inversely with histologic grades.
- Its use in practice is limited by overlap between benign and malignant conditions and variability according to choice of b-values and many other technical parameters.
- ADC value threshold of 750-900 $\mu\text{m}^2/\text{sec}$ may assist in differentiating benign and malignant prostate tissues in the PZ, with ADC values below the threshold correlating with csPCa.

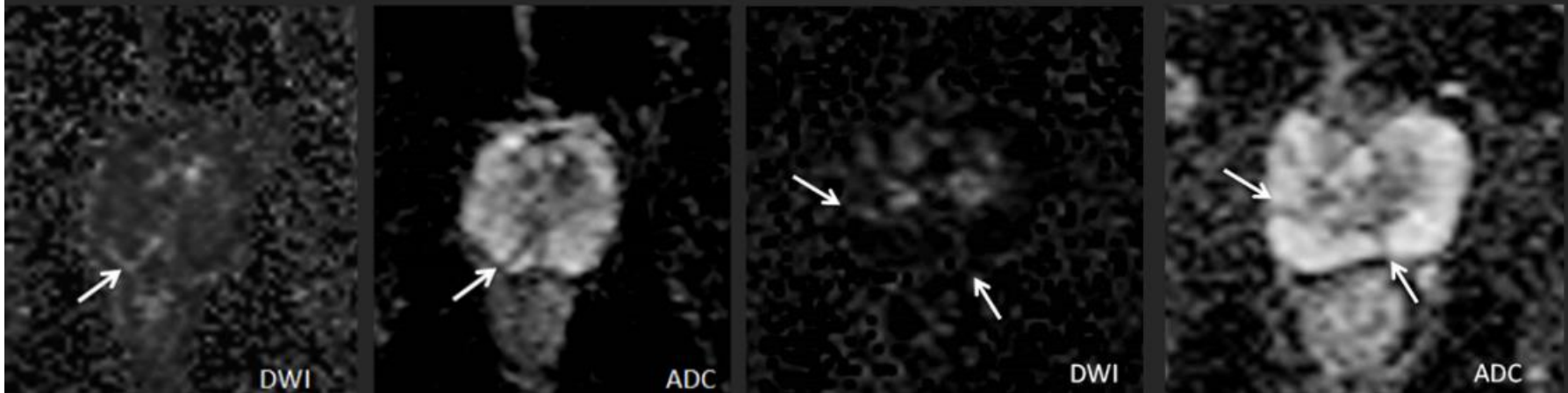
Select the Score number to see the examples

Score	Peripheral Zone DWI criteria
1	No abnormality (i.e., normal) on ADC and high b-value DWI
2	Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI
3	Focal (discrete and different from the background) hypointense on ADC and/or focal hyperintense on high b-value DWI; May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both
4	Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension
5	Same as 4 but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior

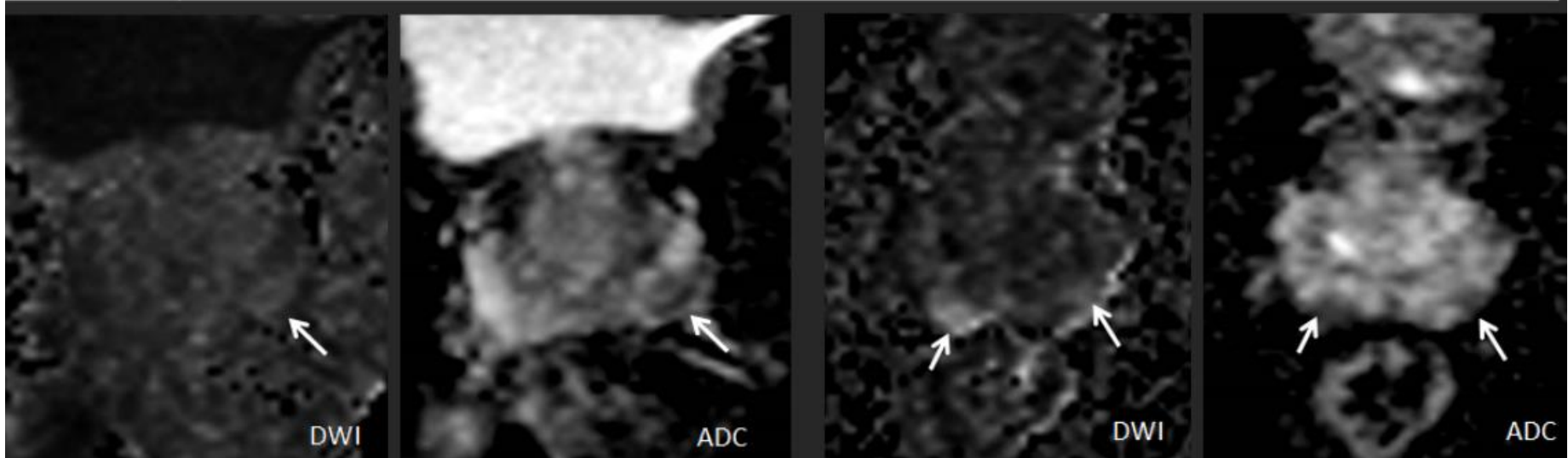
Score	Peripheral Zone DWI criteria
1	No abnormality (i.e., normal) on ADC and high b-value DWI



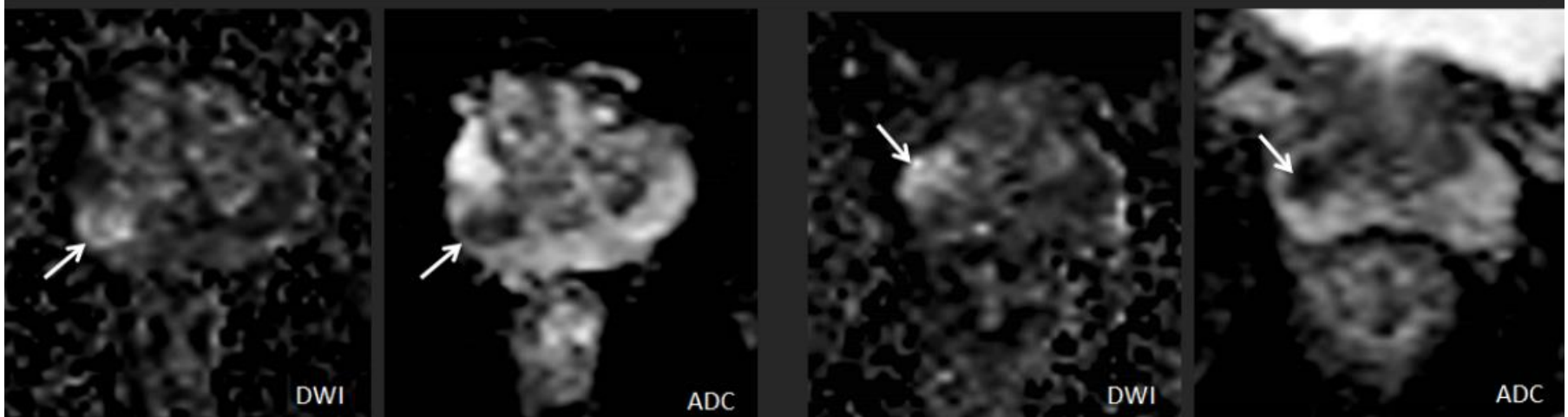
Score	Peripheral Zone DWI criteria
2	Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI



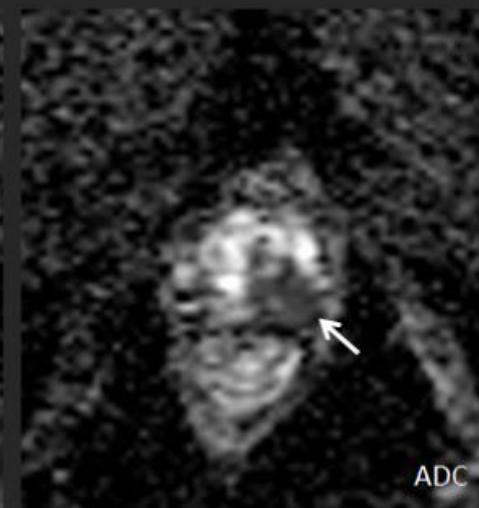
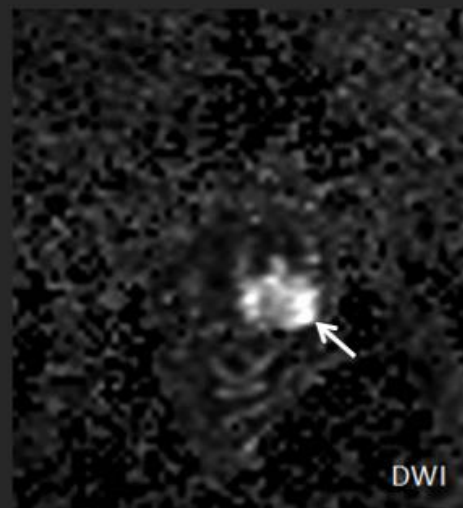
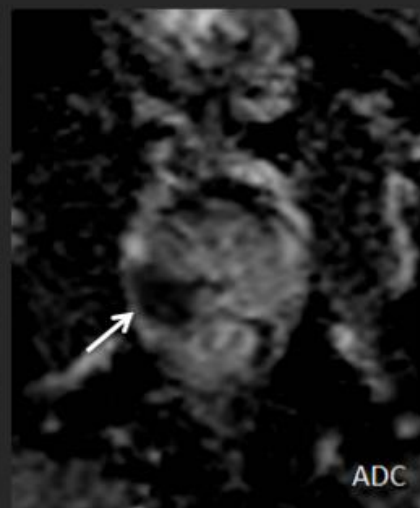
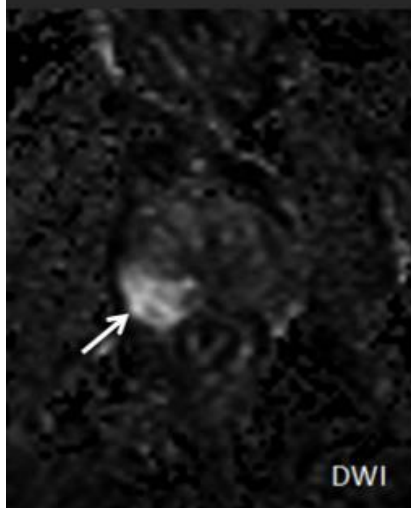
Score	Peripheral Zone DWI criteria
3	Focal (discrete and different from the background) hypointense on ADC and/or focal hyperintense on high b-value DWI; May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both



Score	Peripheral Zone DWI criteria
4	Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension

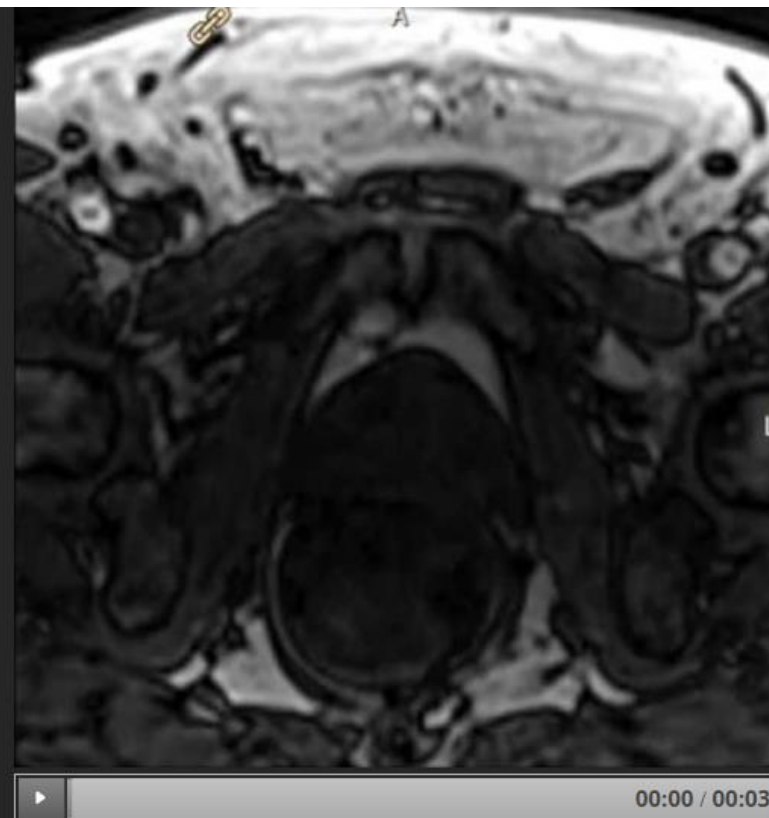


Score	Peripheral Zone DWI criteria
5	Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior



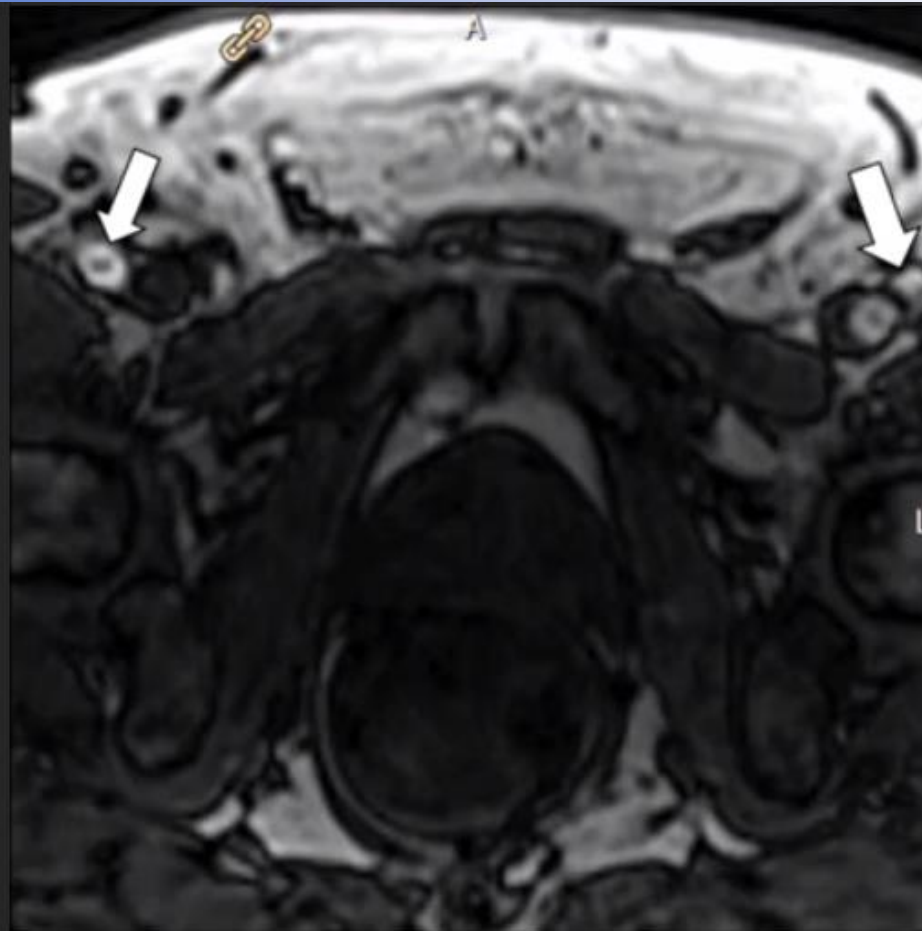
- Dynamic contrast enhanced (DCE) imaging probes tissue perfusion and vascular permeability.
- The evaluation of enhancement is based on a qualitative visual assessment of the individual time points at dynamic contrast-enhanced MR imaging.
- The same DCE criteria apply to PZ and TZ.

[Click here to see more information](#)

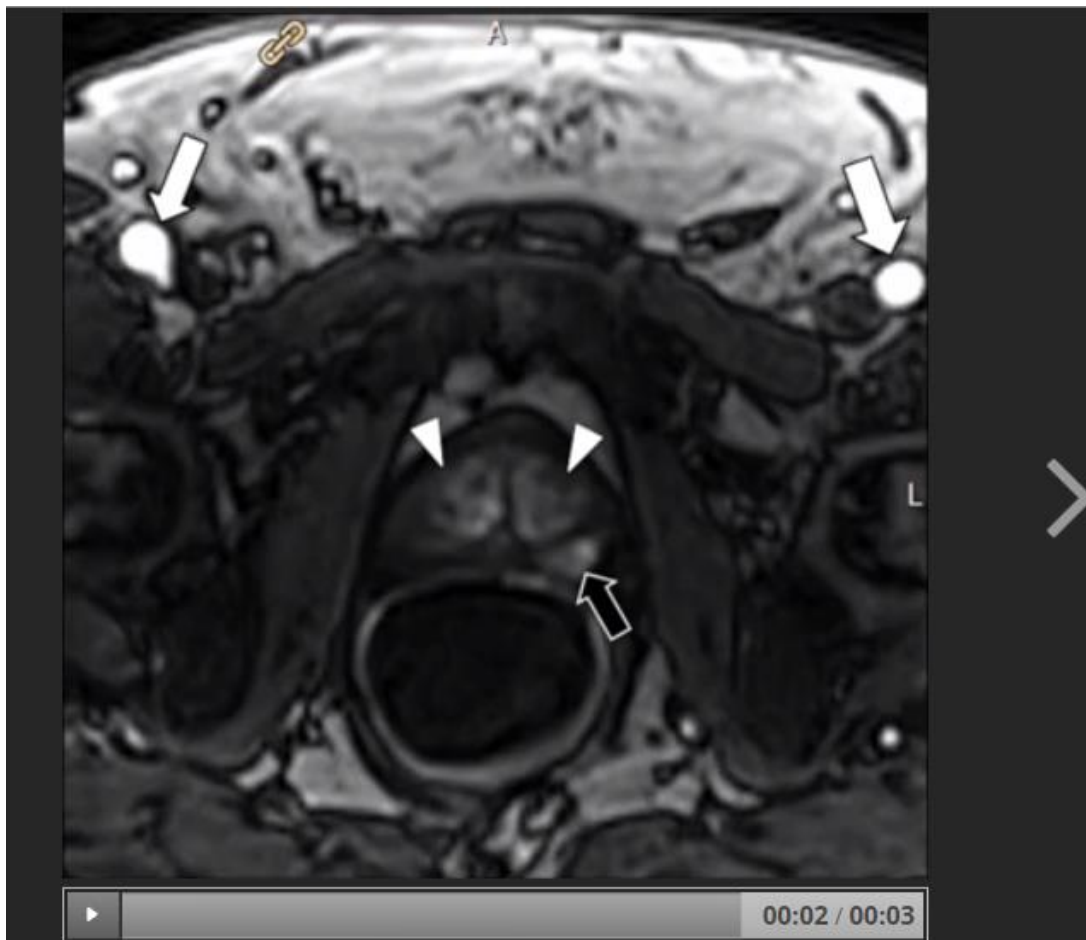


The enhancement of femoral arteries (white arrows) is a good reference to determine the timing of early arterial enhancement. Prostate cancer (black arrow) shows early arterial enhancement that is early or contemporaneous with adjacent normal tissue, such as BPH in the transition zone (arrowheads).

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The enhancement of femoral arteries (white arrows) is a good reference to determine the timing of early arterial enhancement. Prostate cancer (black arrow) shows early arterial enhancement that is early or contemporaneous with adjacent normal tissue, such as BPH in the transition zone (arrowheads).



The enhancement of femoral arteries (white arrows) is a good reference to determine the timing of early arterial enhancement. Prostate cancer (black arrow) shows early arterial enhancement that is early or contemporaneous with adjacent normal tissue, such as BPH in the transition zone (arrowheads).

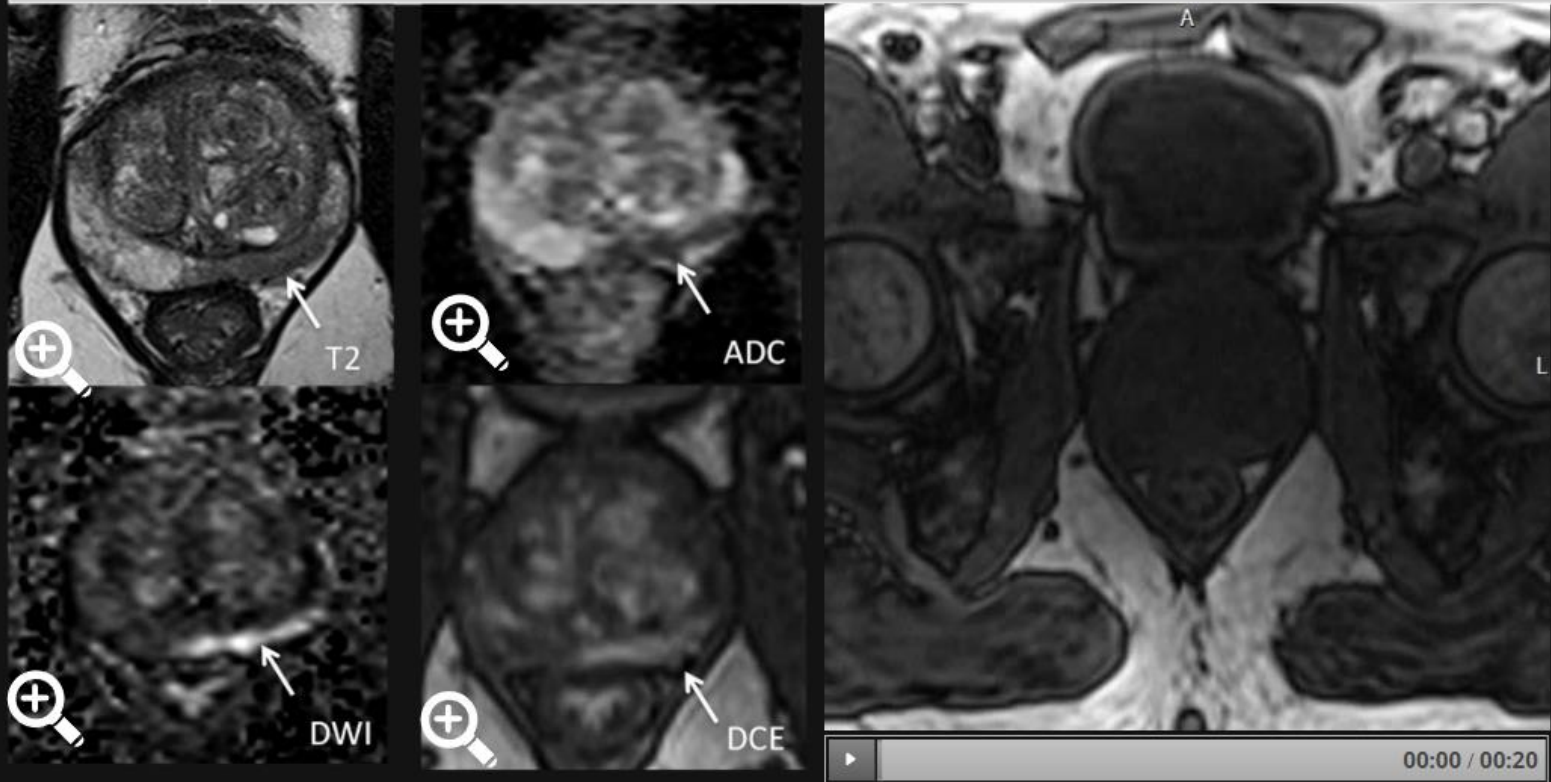
More Information

- Benign conditions such as prostatitis and BPH can also have a similar enhancement pattern, hence DCE plays a minor role in determining PI-RADS Assessment Category.
- Specifically, abnormalities in the peripheral zone that receive a DWI/ADC map score 3 AND demonstrate early arterial enhancement (i.e. DCE positive), may be upgraded the PI-RADS assessment Category 4.

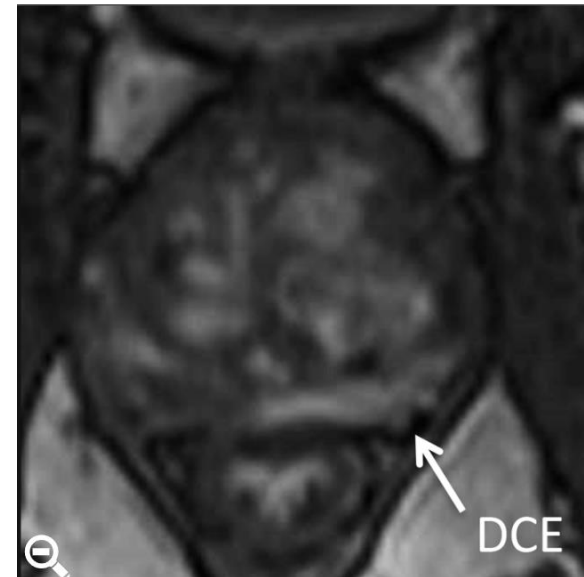
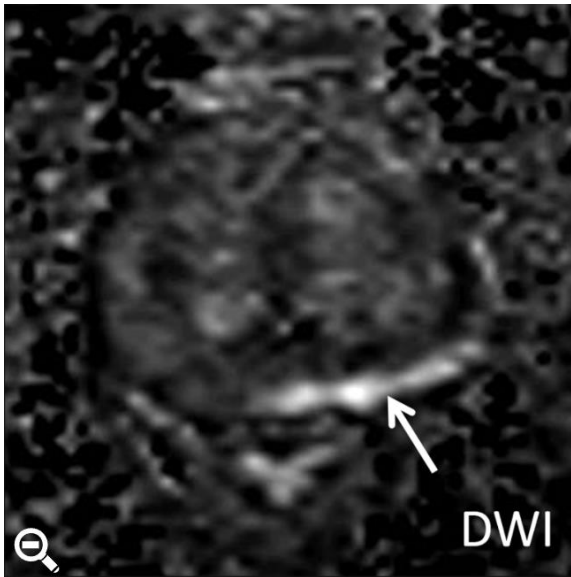
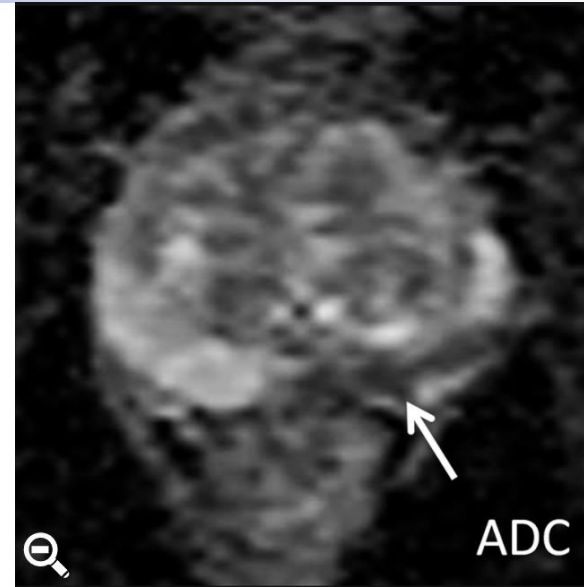
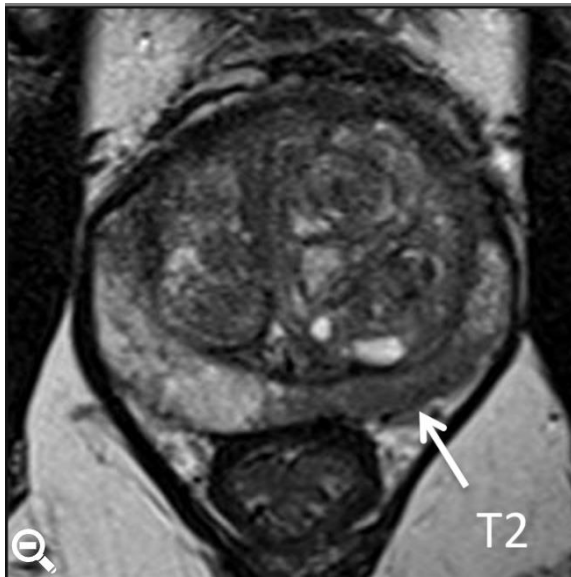
Select the Score – Positive or Negative to see the examples

Score	Peripheral and Transition Zone DCE criteria
Positive	Focal and earlier than or contemporaneously with enhancement of adjacent normal prostatic tissues, and; corresponds to suspicious finding on T2W and/or DWI.
Negative	No early or contemporaneous enhancement; or diffuse multifocal enhancement NOT corresponding to a focal finding on T2W and/or DWI or focal enhancement corresponding to a lesion demonstrating features of BPH on T2WI (including features of extruded BPH in the PZ).

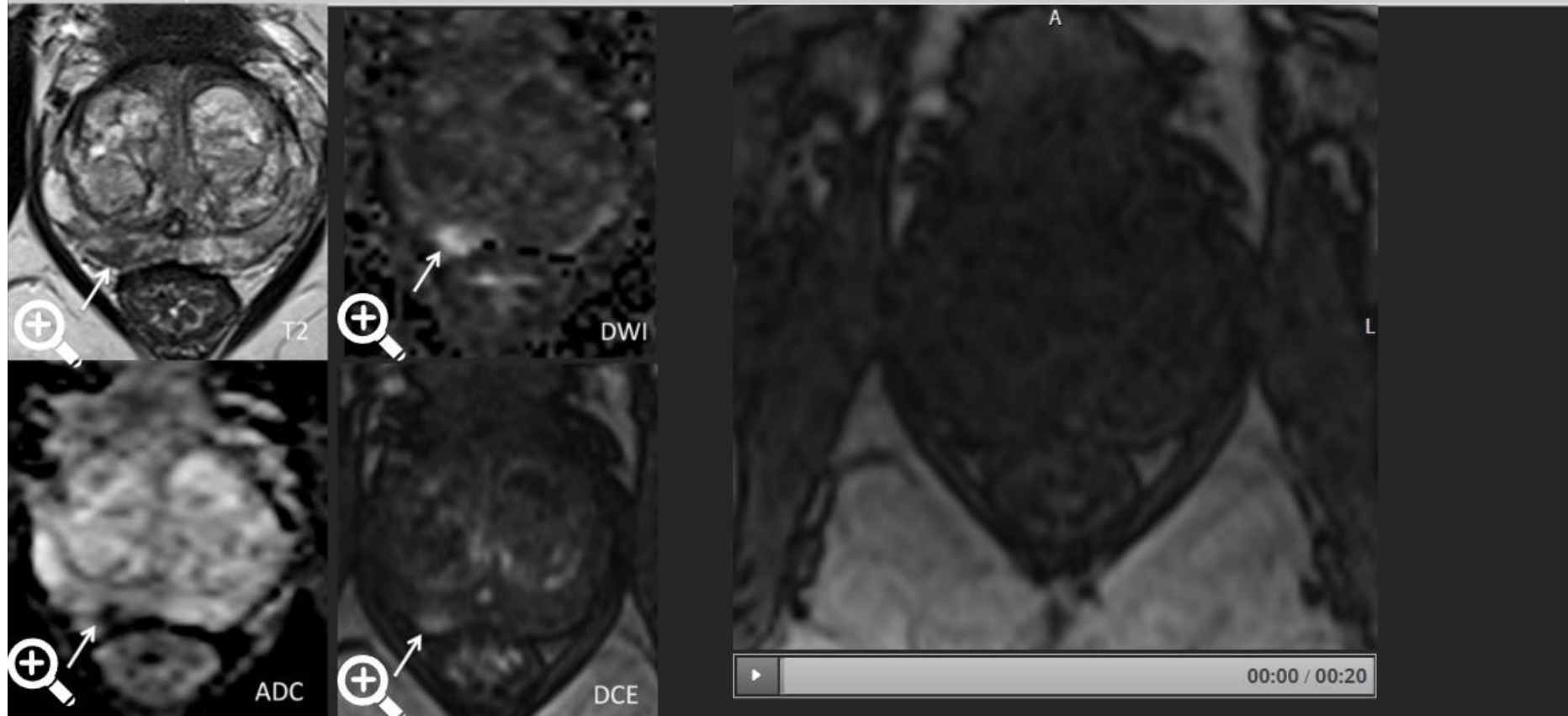
Score	Peripheral and Transition Zone DCE criteria
Positive	Focal and earlier than or contemporaneously with enhancement of adjacent normal prostatic tissues, and; corresponds to suspicious finding on T2W and/or DWI.

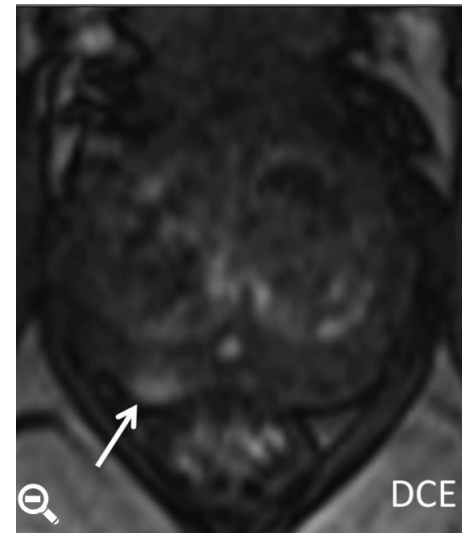
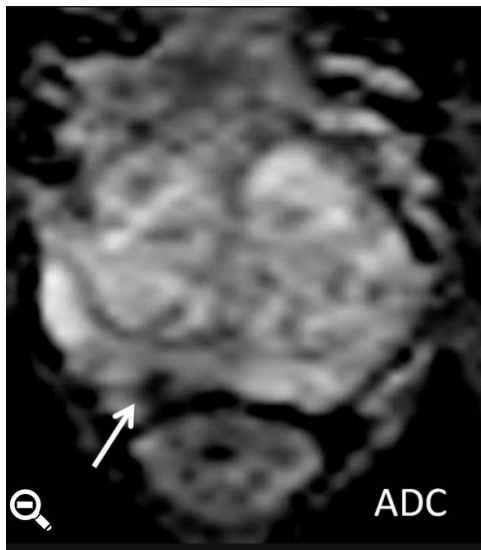
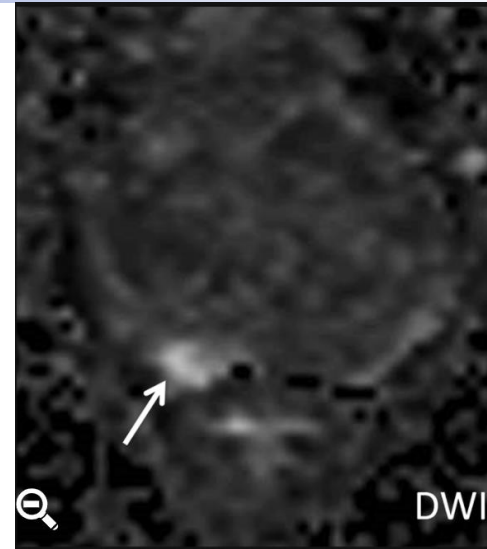
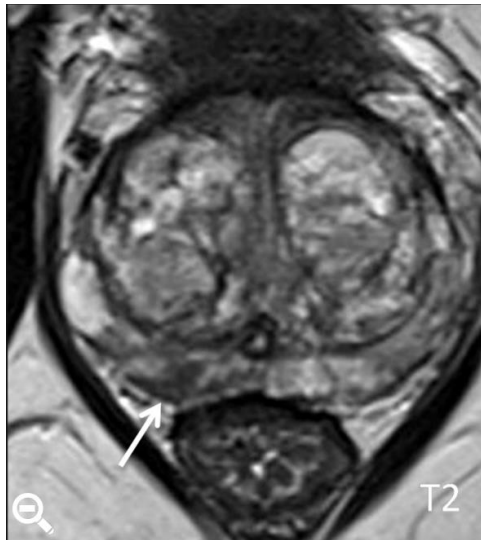


[Click here to view example 2](#)

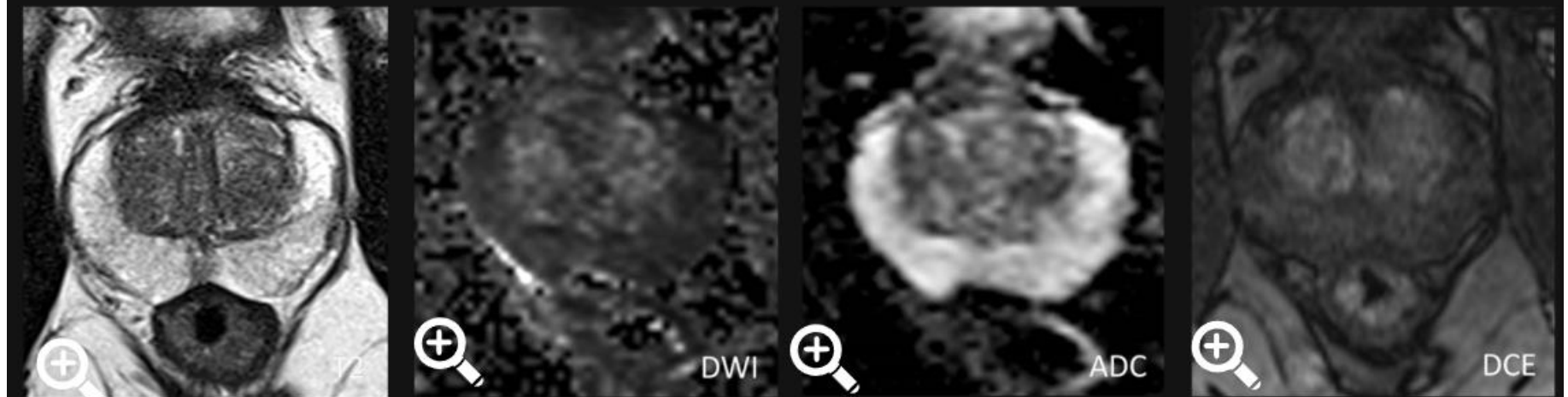


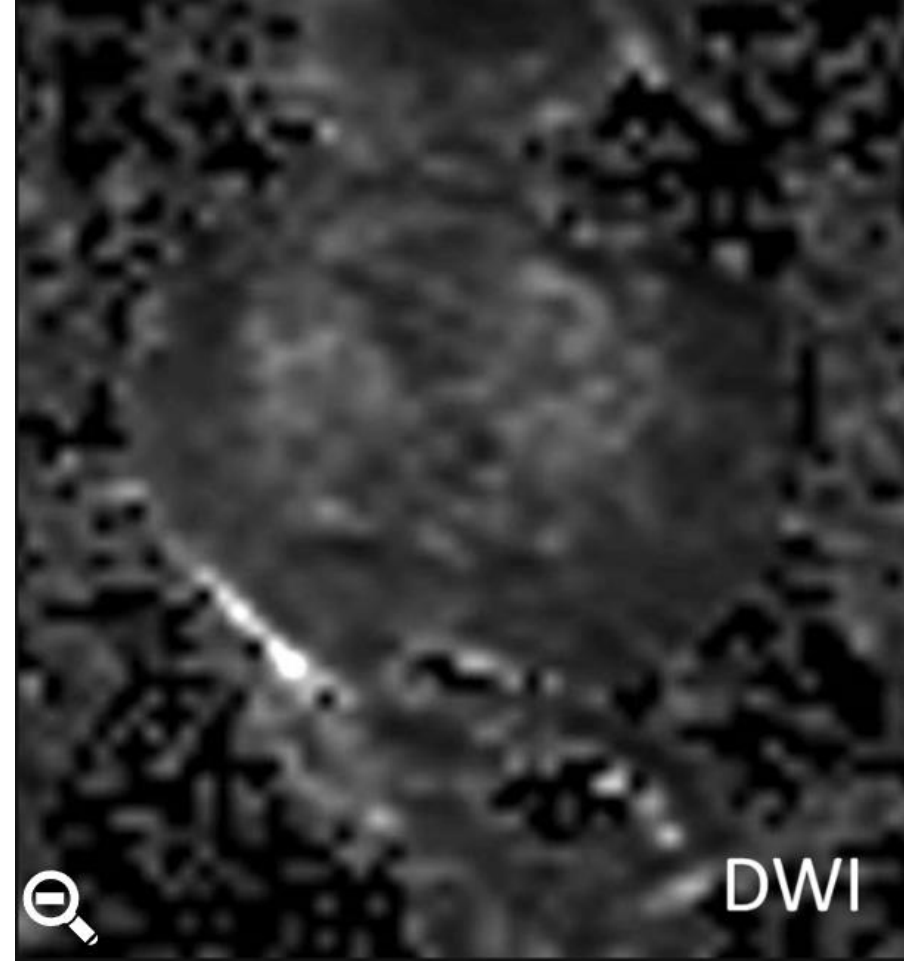
Score	Peripheral and Transition Zone DCE criteria
Positive	Focal and earlier than or contemporaneously with enhancement of adjacent normal prostatic tissues, and; corresponds to suspicious finding on T2W and/or DWI.

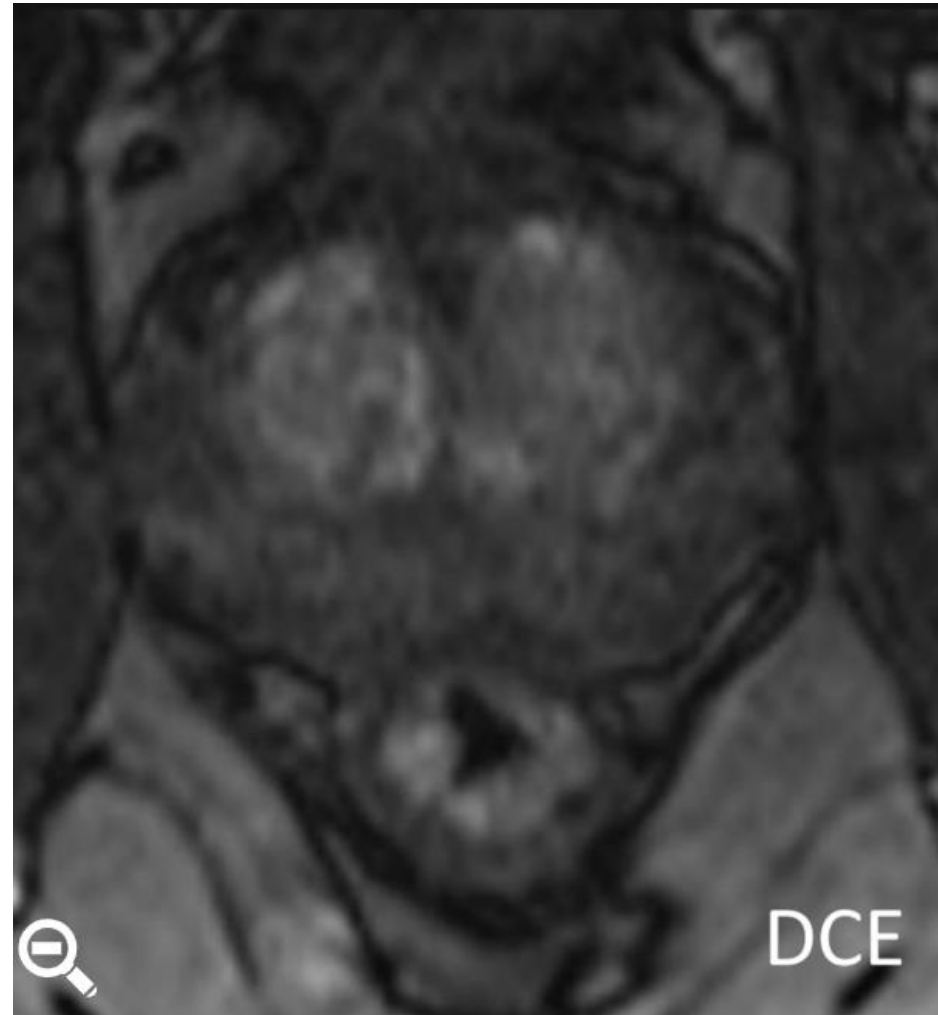
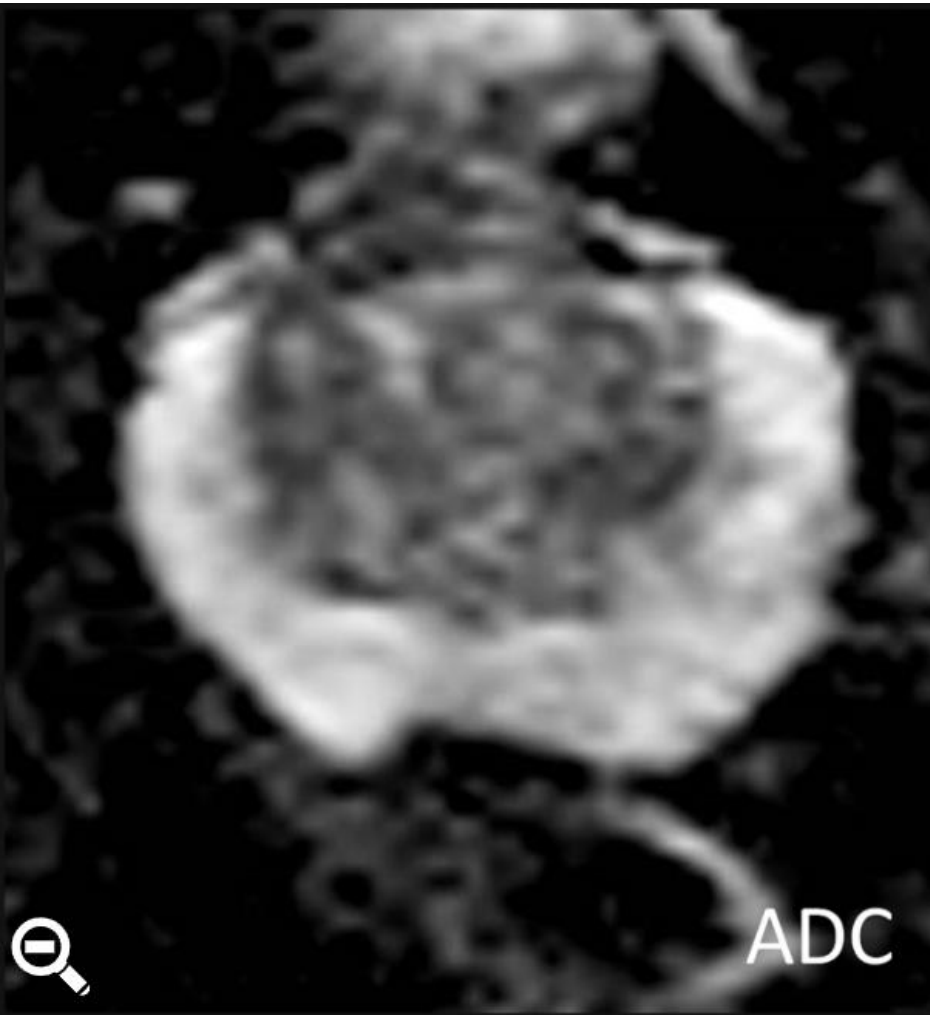




Score	Peripheral and Transition Zone DCE criteria
Negative	No early or contemporaneous enhancement; or diffuse multifocal enhancement NOT corresponding to a focal finding on T2W and/or DWI or focal enhancement corresponding to a lesion demonstrating features of BPH on T2WI (including features of extruded BPH in the PZ).



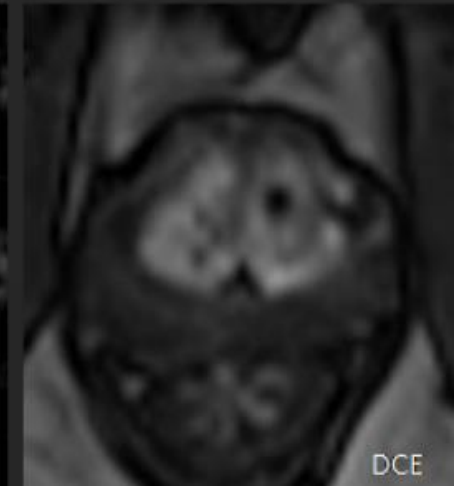
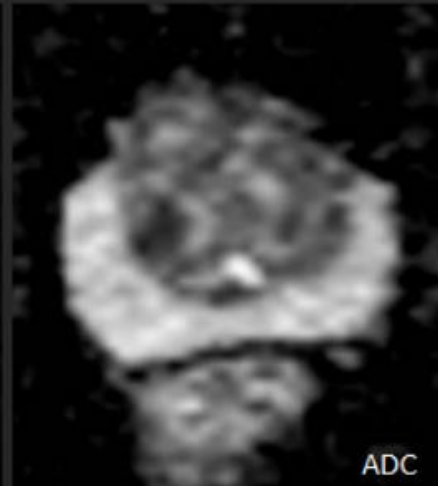
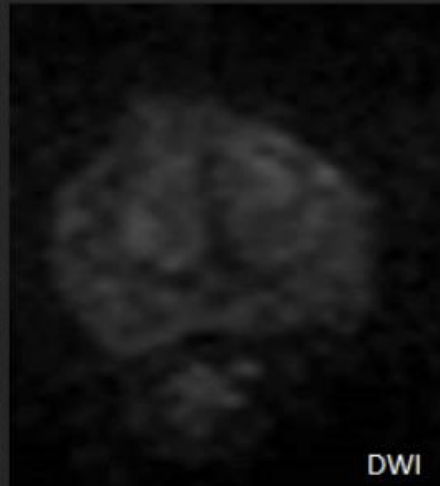




Select the PI-RADS assessment category to see the examples

Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
No abnormality (i.e., normal) on ADC and high b-value DWI	1	N/A	PI-RADS 1 (highly unlikely)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)
Focal (discrete and different from the background) hypointense on ADC and/or focal hyperintense on high b-value DWI; May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both.	3	Negative or not available	PI-RADS 3 (equivocal)
		Positive	PI-RADS 4 (likely)
Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension	4	N/A	PI-RADS 4 (likely)
Same as 4 but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	PI-RADS 5 (highly likely)

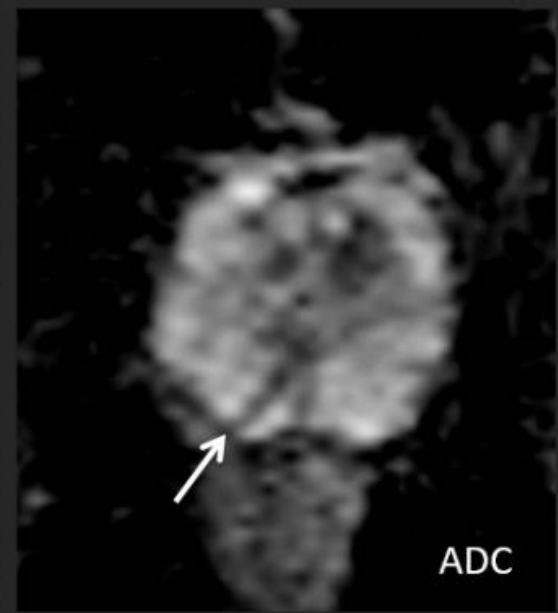
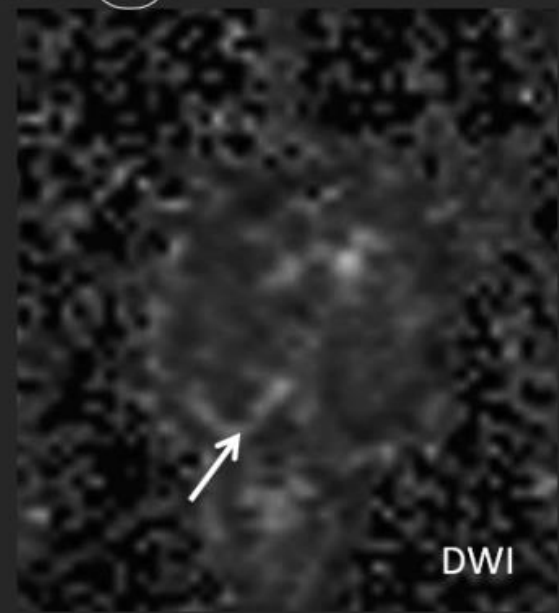
Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
No abnormality (i.e., normal) on ADC and high b-value DWI	1	N/A	PI-RADS 1 (highly unlikely)



Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)

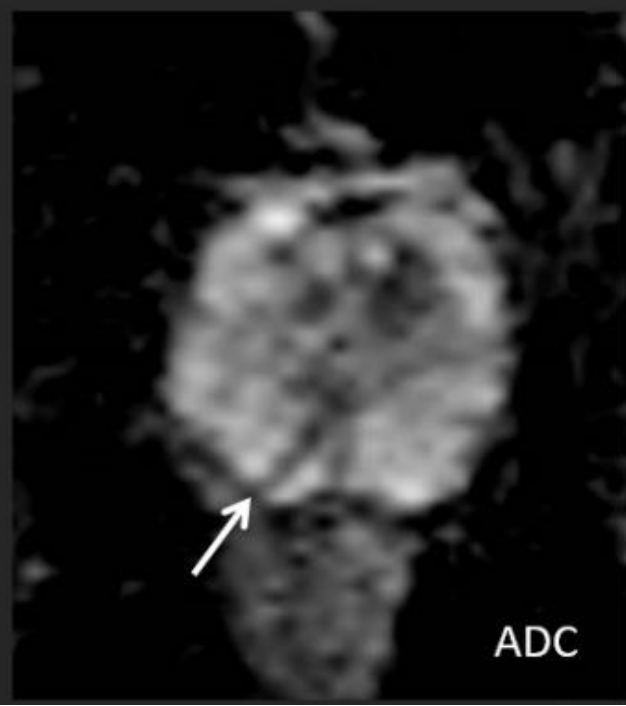
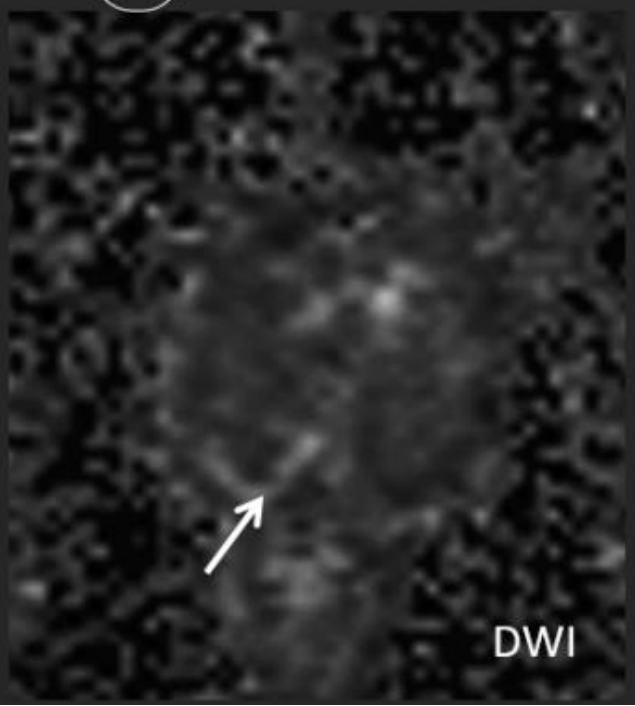
Select the case number to see the different case images

Case **1** 2 3 4

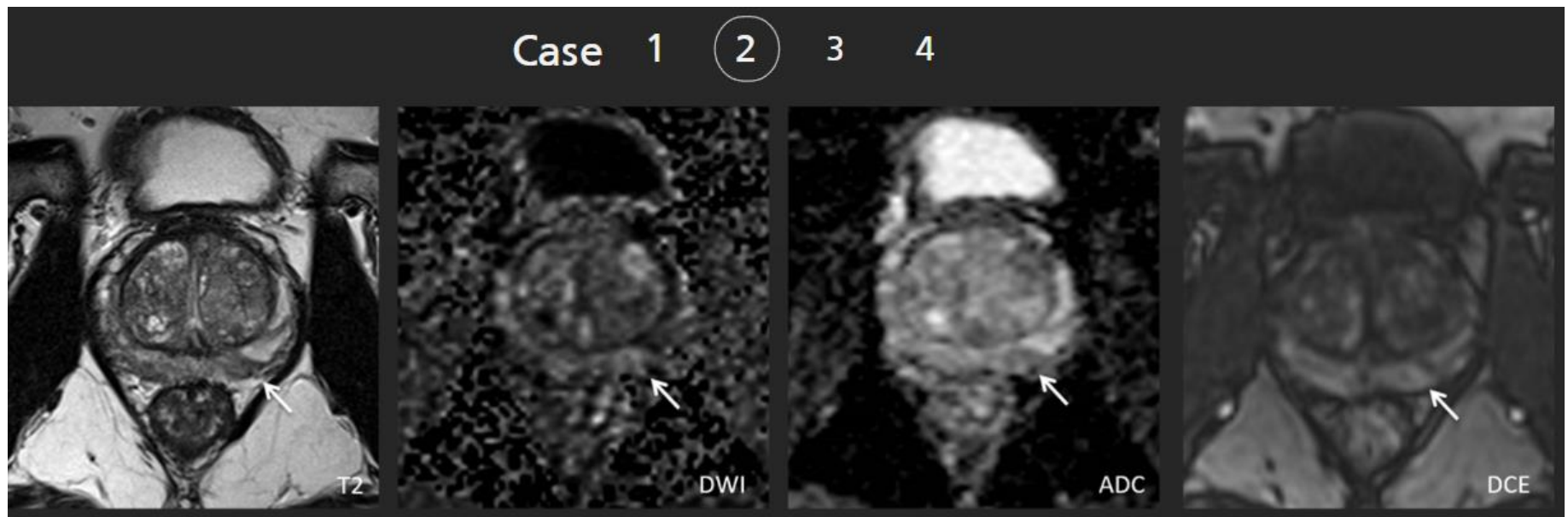


Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)

Case **1** 2 3 4




Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)

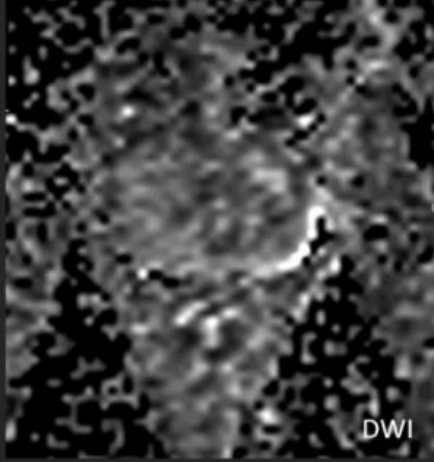


Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)

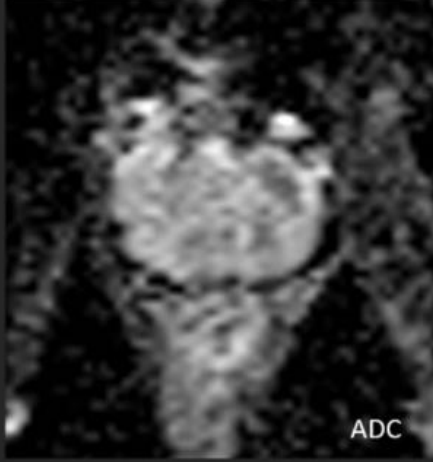
Case 1 2 **3** 4




T2



DWI



ADC

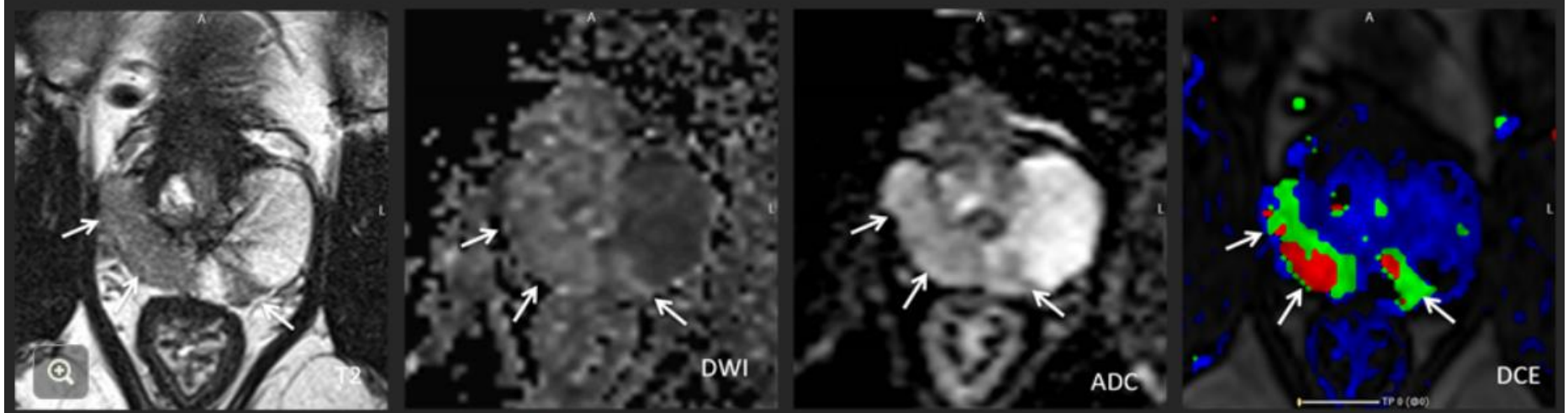


DCE

Caveat: Mild diffuse changes are more likely to be benign.

Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)

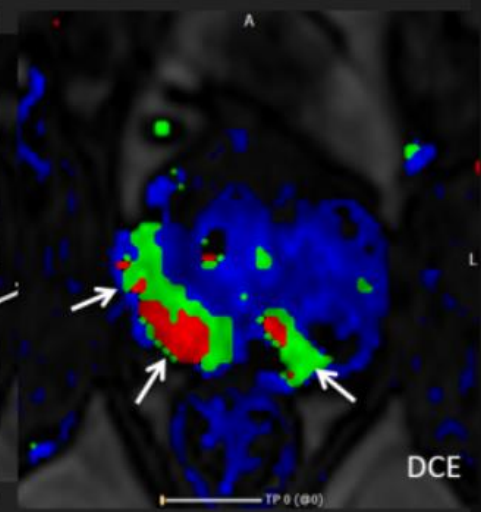
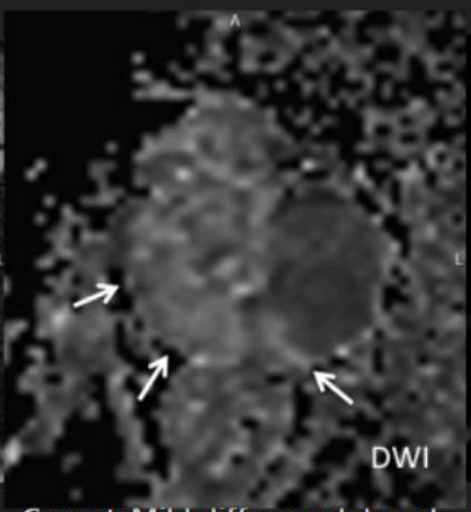
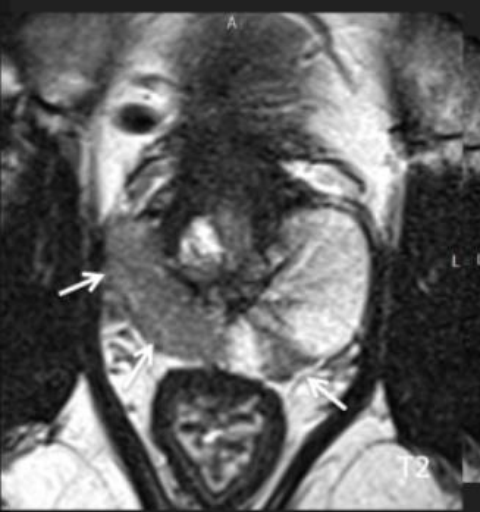
Case 1 2 3 4



Caveat: Mild diffuse or lobar changes are more likely to be benign.

Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Linear/wedge shaped hypointense on ADC and/or linear/wedge shaped hyperintense on high b-value DWI	2	N/A	PI-RADS 2 (unlikely)

Case 1 2 3 4



Caveat: Mild diffuse or lobar changes are more likely to be benign.

Peripheral zone (PZ)
Dominant parameter: DWI

DWI Score

Ancillary parameter
DCE

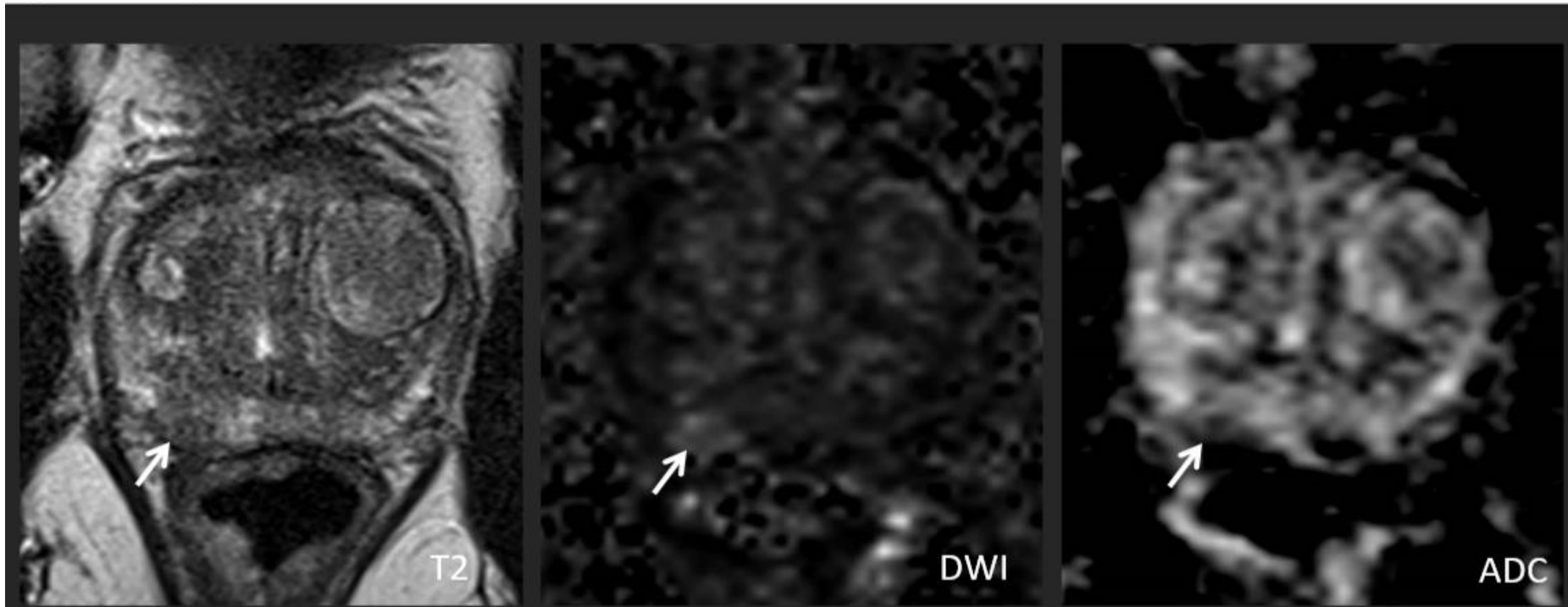
PI-RADS assessment category
(likelihood of csPCa)

Focal (discrete and different from the background) hypointense on ADC and/or focal hyperintense on high b-value DWI;
May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both.

3

Negative or not available

PI-RADS 3 (equivocal)



Peripheral zone (PZ)
Dominant parameter: DWI

DWI Score

Ancillary parameter
DCE

PI-RADS assessment category
(likelihood of csPCa)



Focal (discrete and different from the background) hypointense on ADC and/or focal hyperintense on high b-value DWI; May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both.

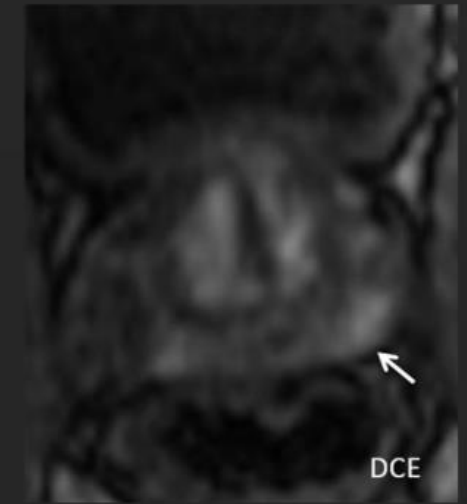
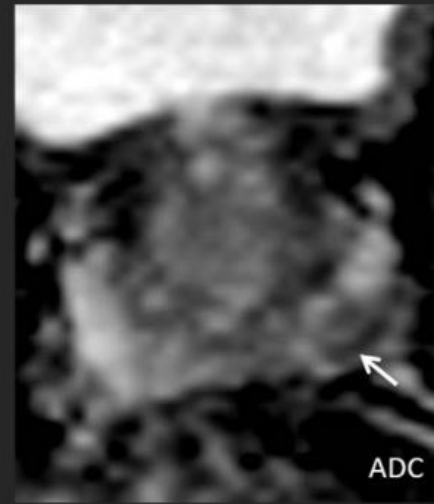
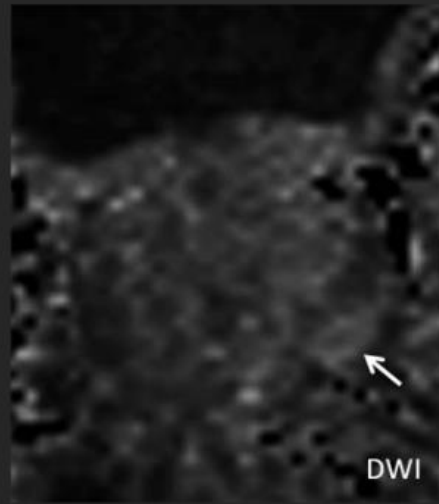
3

Positive

PI-RADS 4 (likely)

Select the case number to see the different case images

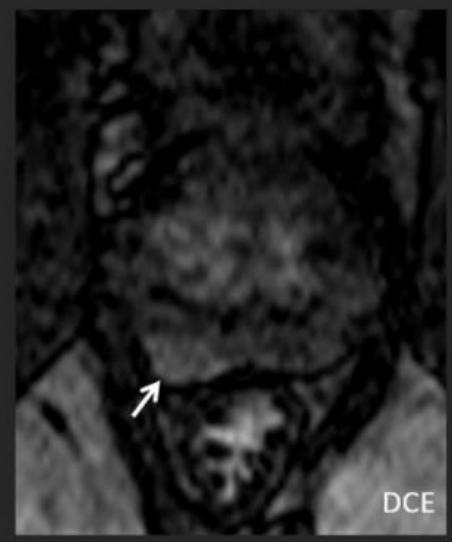
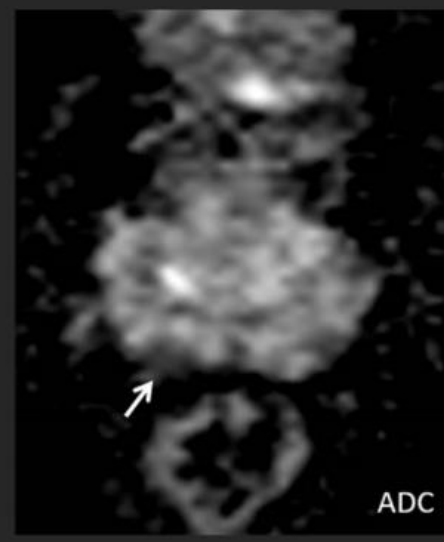
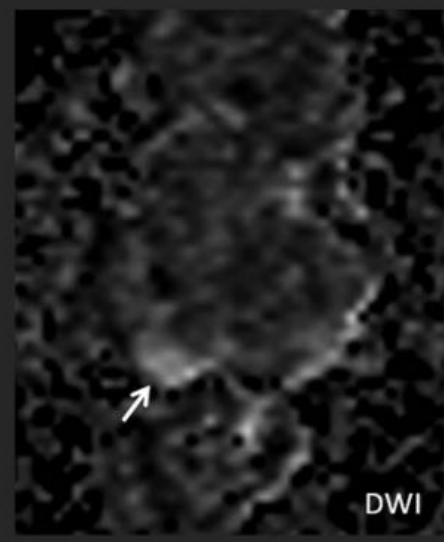
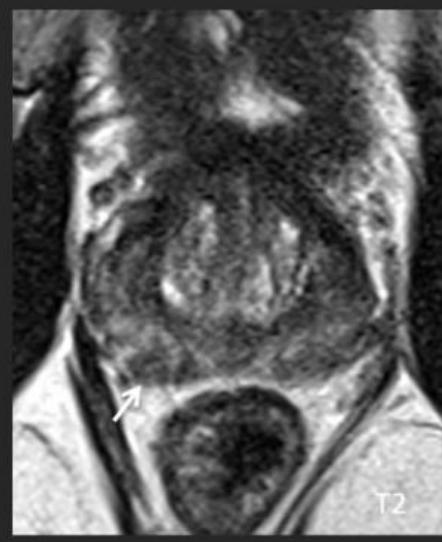
Case **1** 2



Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Focal (discrete and different from the background) hypointense on ADC and/or focal hyperintense on high b-value DWI; May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both.	3	Positive	PI-RADS 4 (likely)

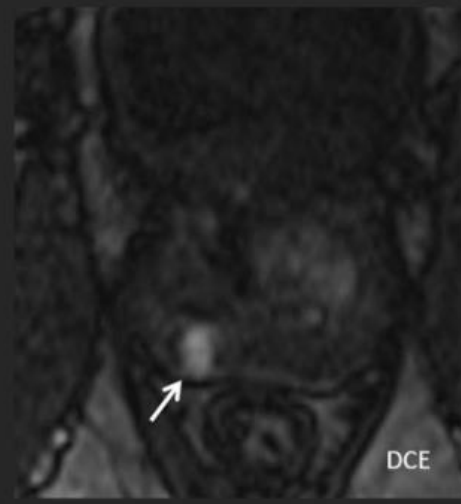
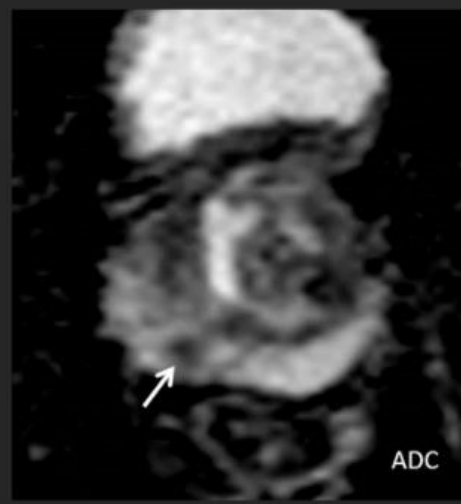
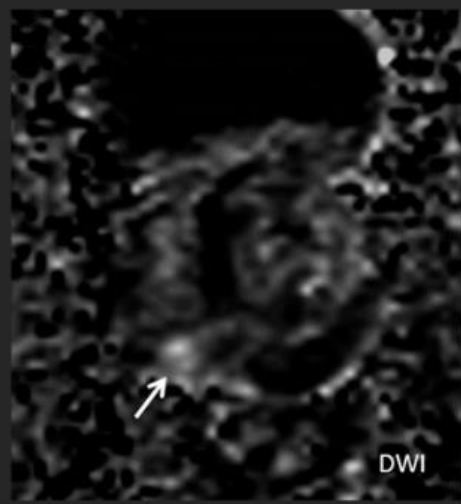
Select the case number to see the different case images

Case 1 2



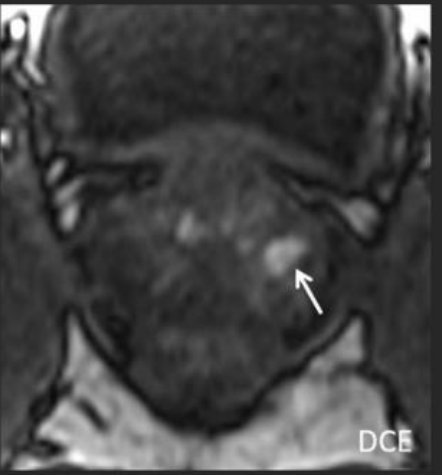
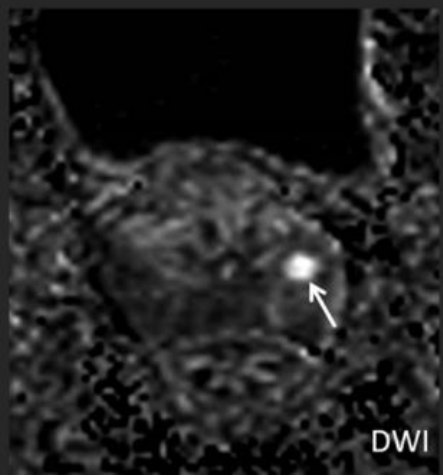
Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension	4	N/A	PI-RADS 4 (likely)

Case **1** 2 3 4



Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension	4	N/A	PI-RADS 4 (likely)

Case 1 2 3 4



Peripheral zone (PZ)
Dominant parameter: DWI

DWI Score

Ancillary parameter
DCE

PI-RADS assessment category
(likelihood of csPCa)

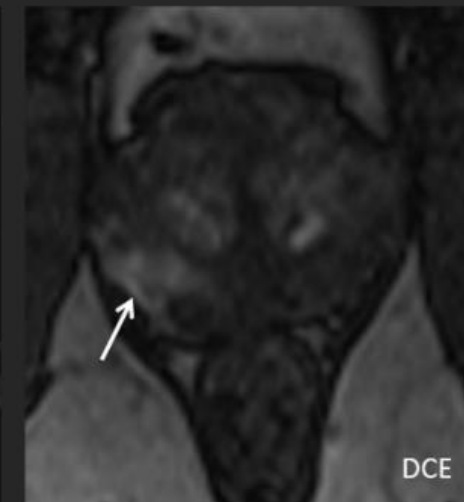
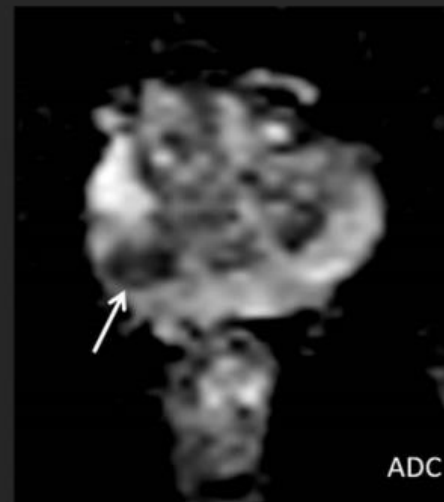
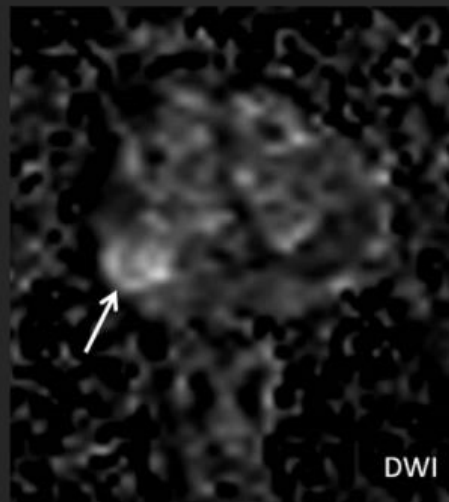
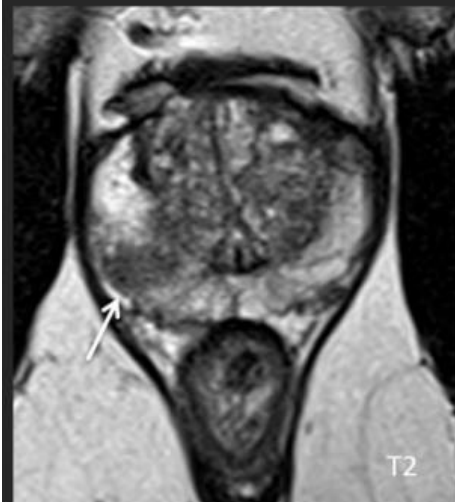
Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension

4

N/A

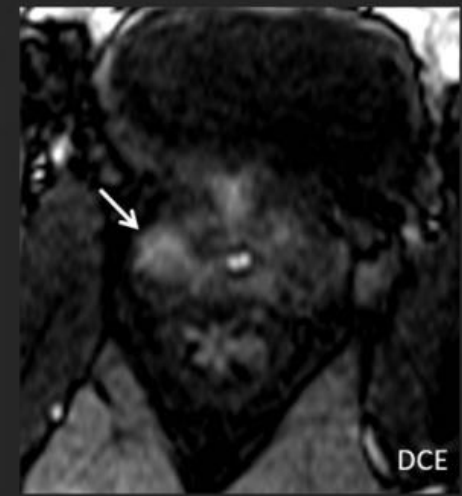
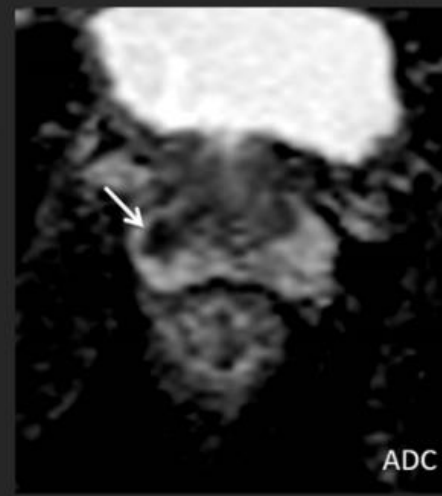
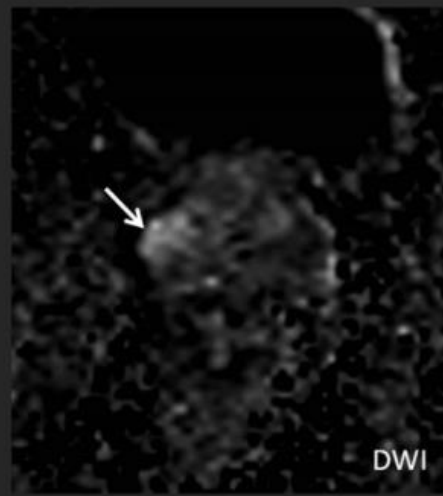
PI-RADS 4 (likely)

Case 1 2 3 4



Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; < 1.5cm in greatest dimension	4	N/A	PI-RADS 4 (likely)

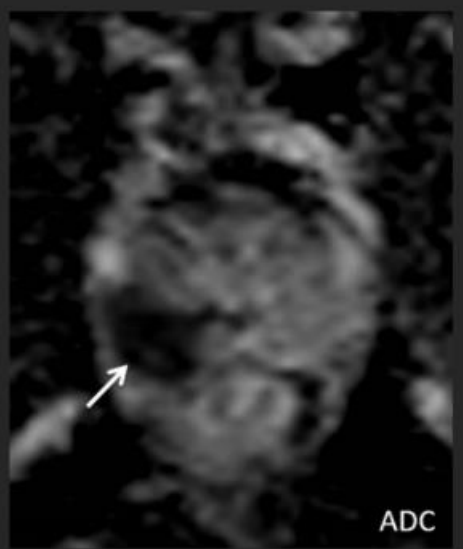
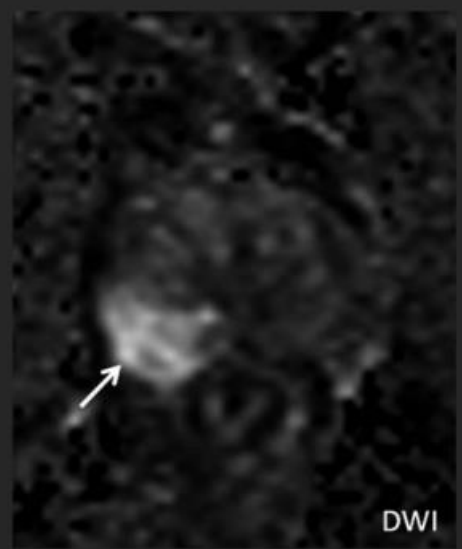
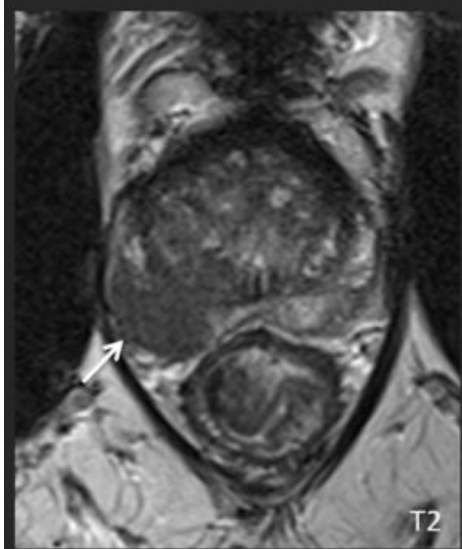
Case 1 2 3 4



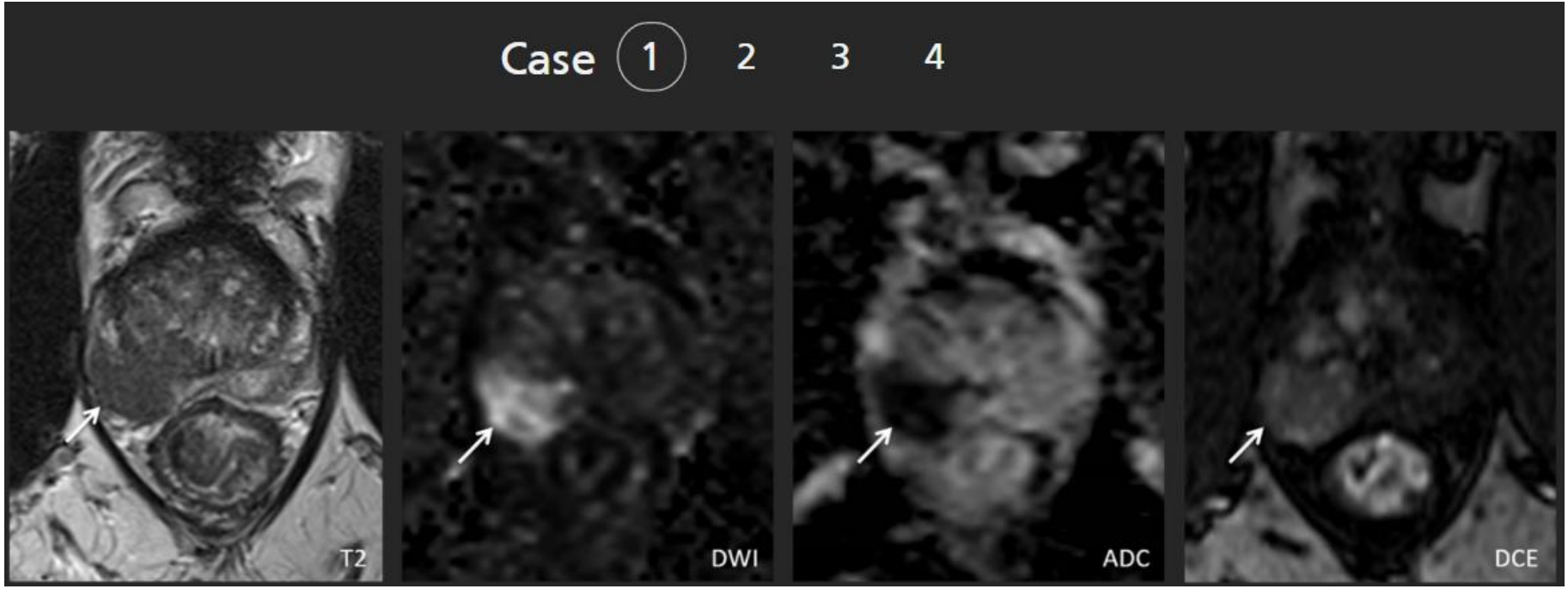
Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	PI-RADS 5 (highly likely)

Select the case number to see the different case images

Case **1** 2 3 4



Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	PI-RADS 5 (highly likely)



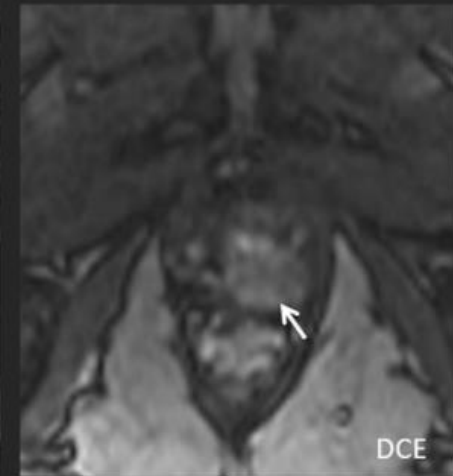
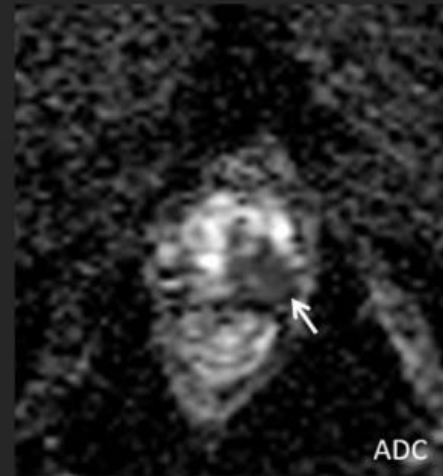
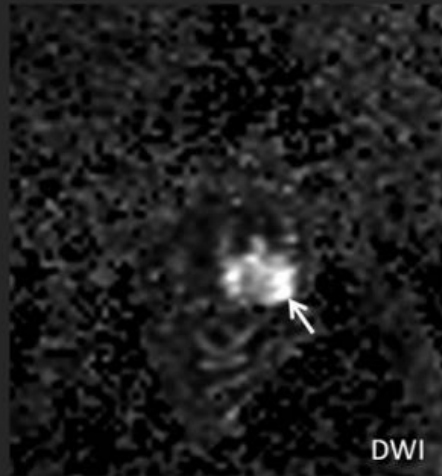
Peripheral zone (PZ)	DWI Score	Ancillary parameter	PI-RADS assessment category
Peripheral zone (PZ) Dominant parameter: DWI		Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	PI-RADS 5 (highly likely)

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Select the case number to see the different case images

Case 1 (2) 3 4



Peripheral zone (PZ)
Dominant parameter: DWI

DWI Score

Ancillary parameter
DCE

PI-RADS assessment category
(likelihood of csPCa)

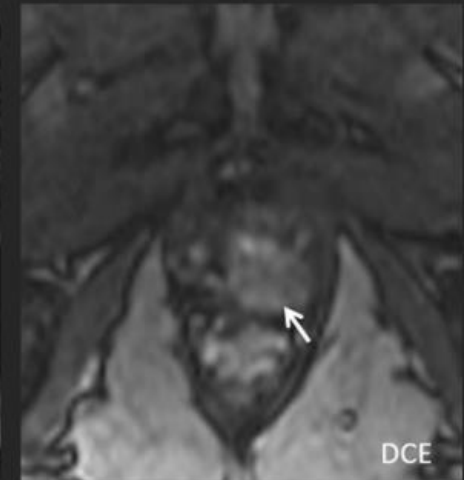
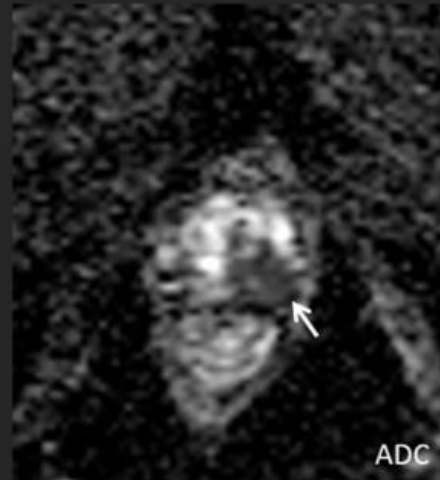
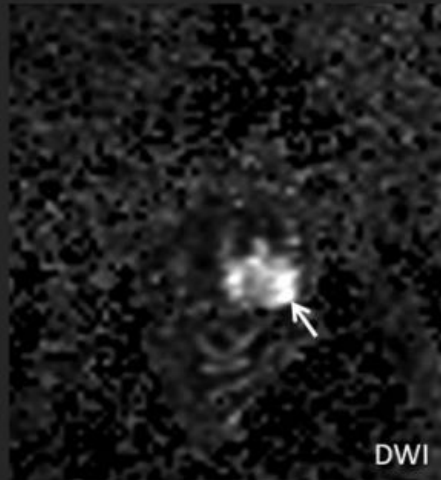
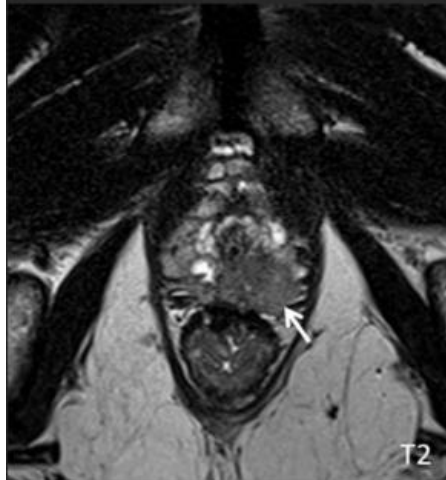
Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior

5

N/A

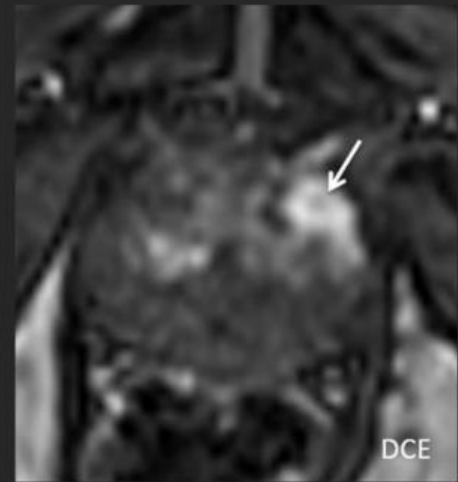
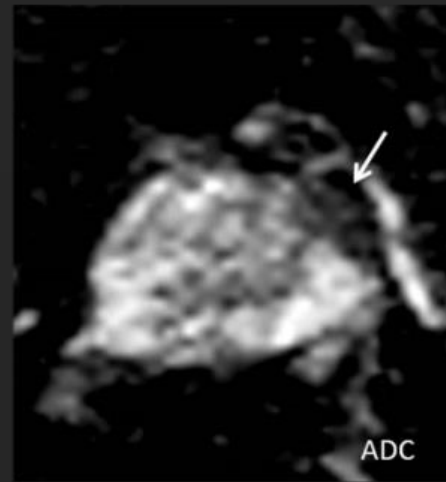
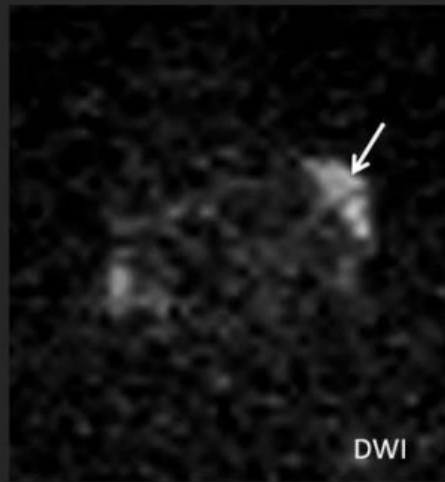
PI-RADS 5 (highly likely)

Case 1 2 3 4



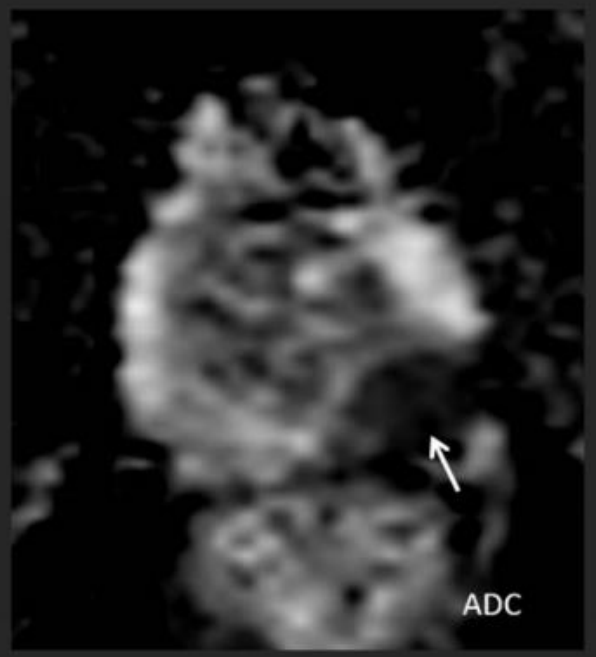
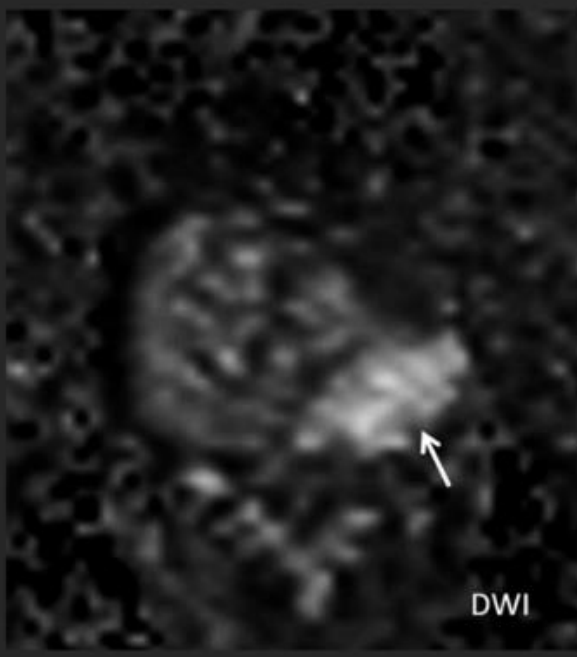
Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	PI-RADS 5 (highly likely)

Case 1 2 **3** 4



Peripheral zone (PZ) Dominant parameter: DWI	DWI Score	Ancillary parameter DCE	PI-RADS assessment category (likelihood of csPCa)
Same as 4 but $\geq 1.5\text{cm}$ in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	PI-RADS 5 (highly likely)

Case 1 2 3 **4**

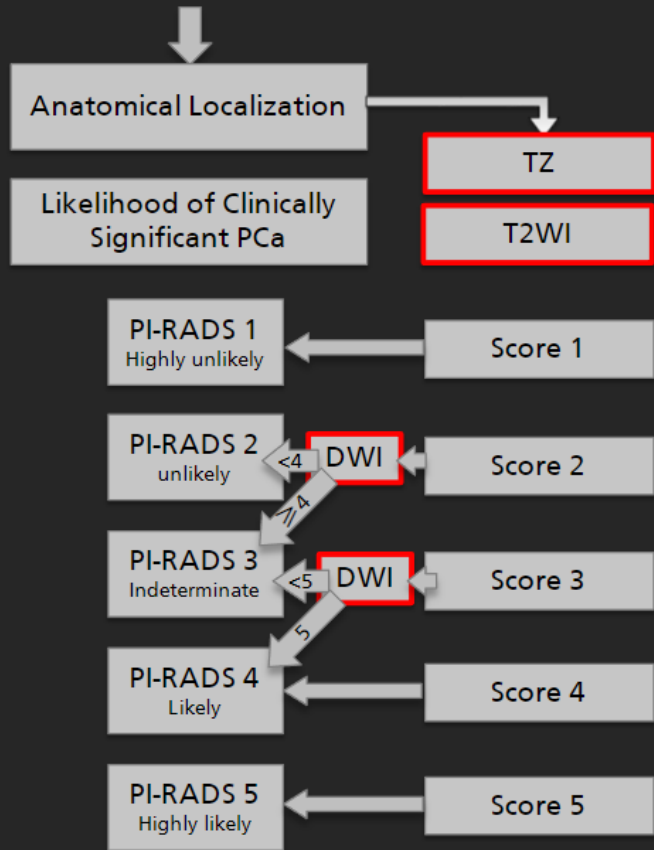


Transition Zone Assessment - What to Score in the TZ

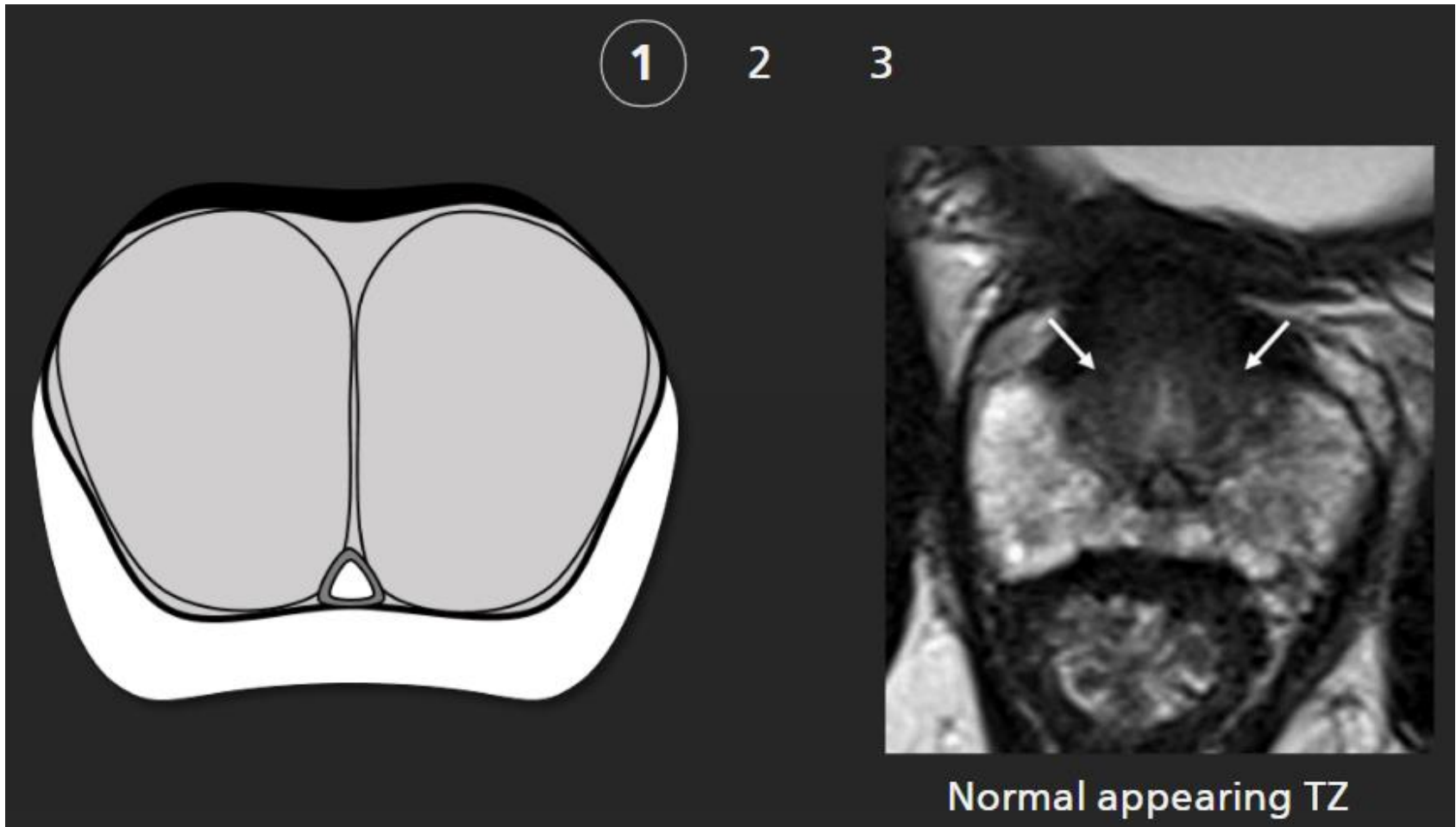
- Findings of BPH alone are considered a normal variant and should be assigned a T2W score of 1. These types of nodules do not have to be separately reported.
- Focal lesions, nodules, or regions in the TZ with features known to be associated with malignancy on T2W or DWI and that differ from the predominant imaging characteristics of the background should be scored. This include:
 - Focal lesions that are different from BPH nodules in having
 - obscured margins,
 - lenticular shape, or
 - invasive behavior on T2WI.
 - Lesions/nodules or region between nodules with more restricted diffusion than background.

Transition Zone Assessment - How to Score in the TZ

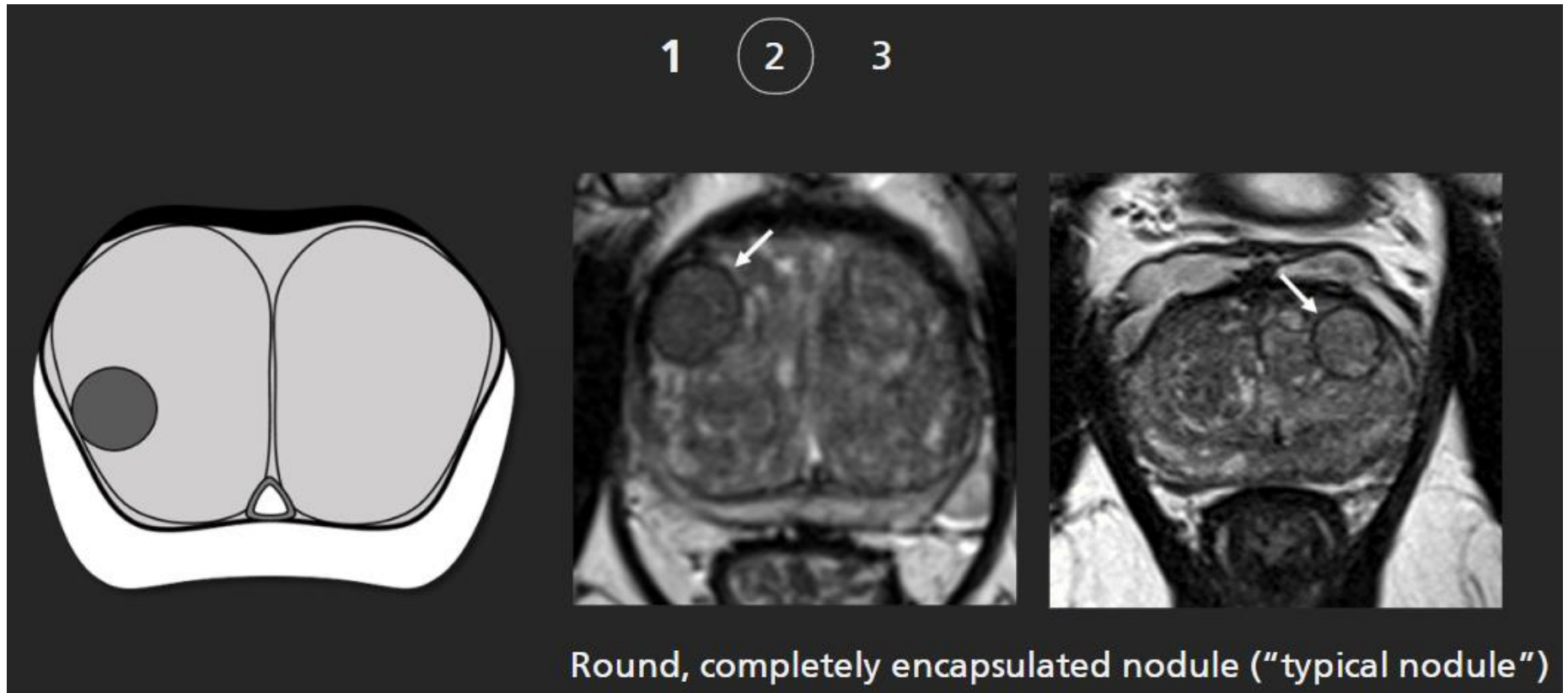
- The T2W score is the dominant factor that determines the overall PI-RADS assessment category in the TZ.
- Atypical TZ nodules (T2W score of 2) are upgraded to PI-RADS assessment category 3 if they have a DWI score of ≥ 4 (i.e., with markedly restricted diffusion).
- Lesions with indeterminate features for prostate cancer (T2W score of 3) are upgraded to PI-RADS assessment category 4 if they have a DWI score 5 (i.e. with markedly restricted diffusion AND measuring ≥ 1.5 cm OR with invasive behavior).



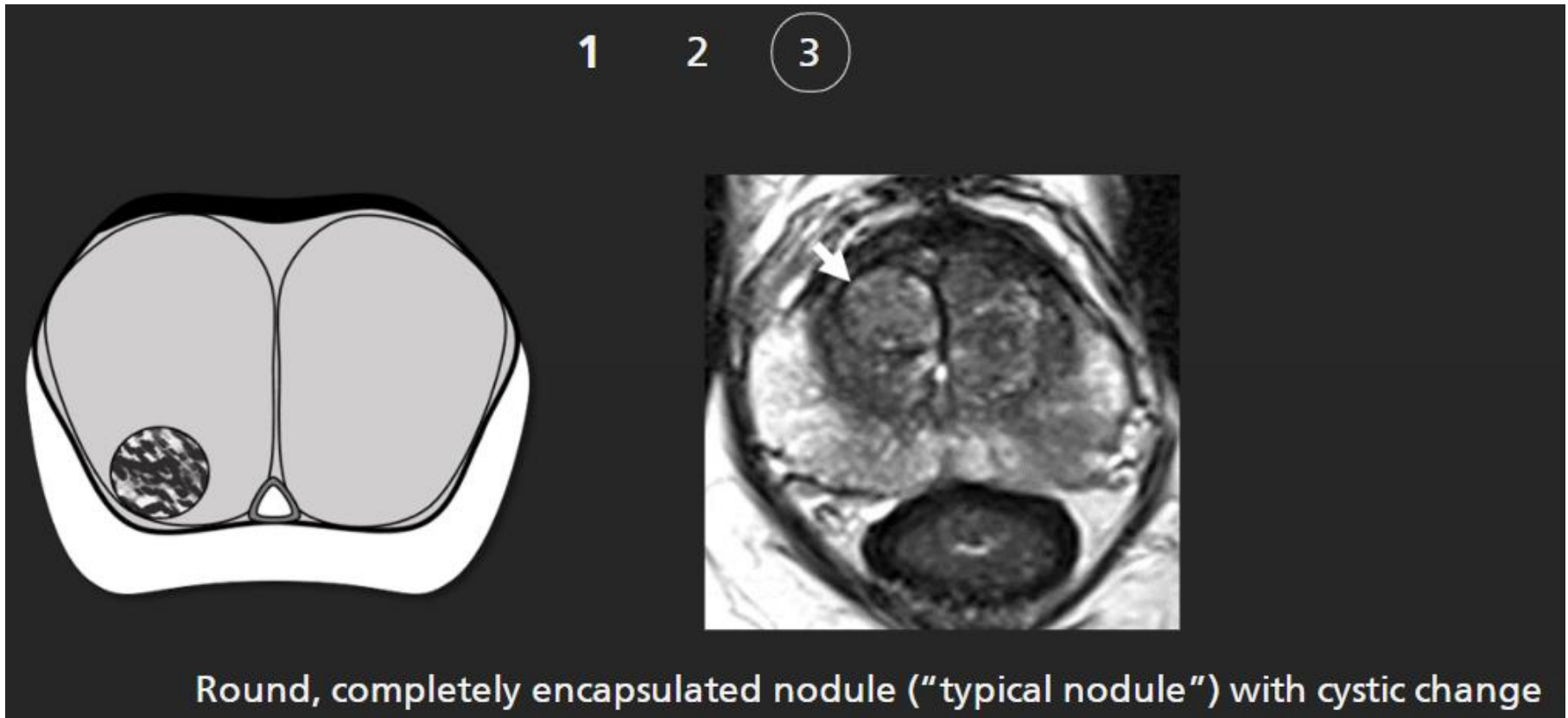
Score	Transition Zone T2W criteria
1	Normal appearing TZ (rare) or a round, completely encapsulated nodule (“typical nodule”)



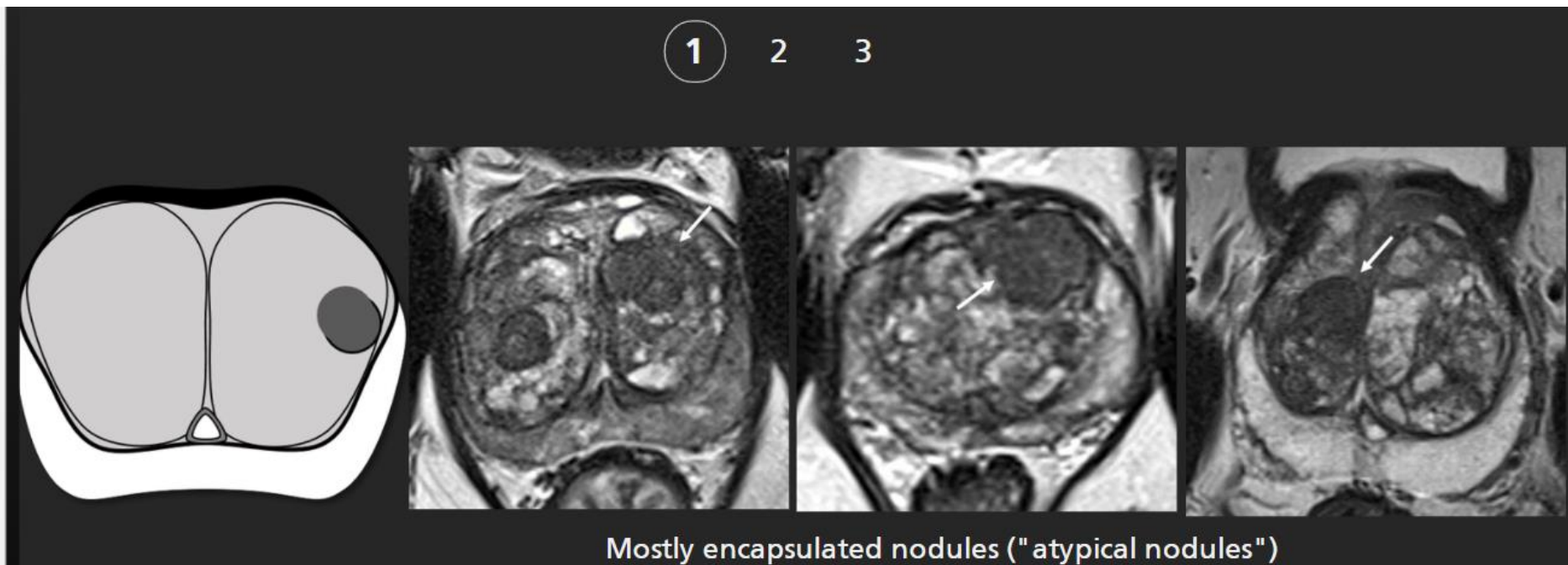
Score	Transition Zone T2W criteria
1	Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")



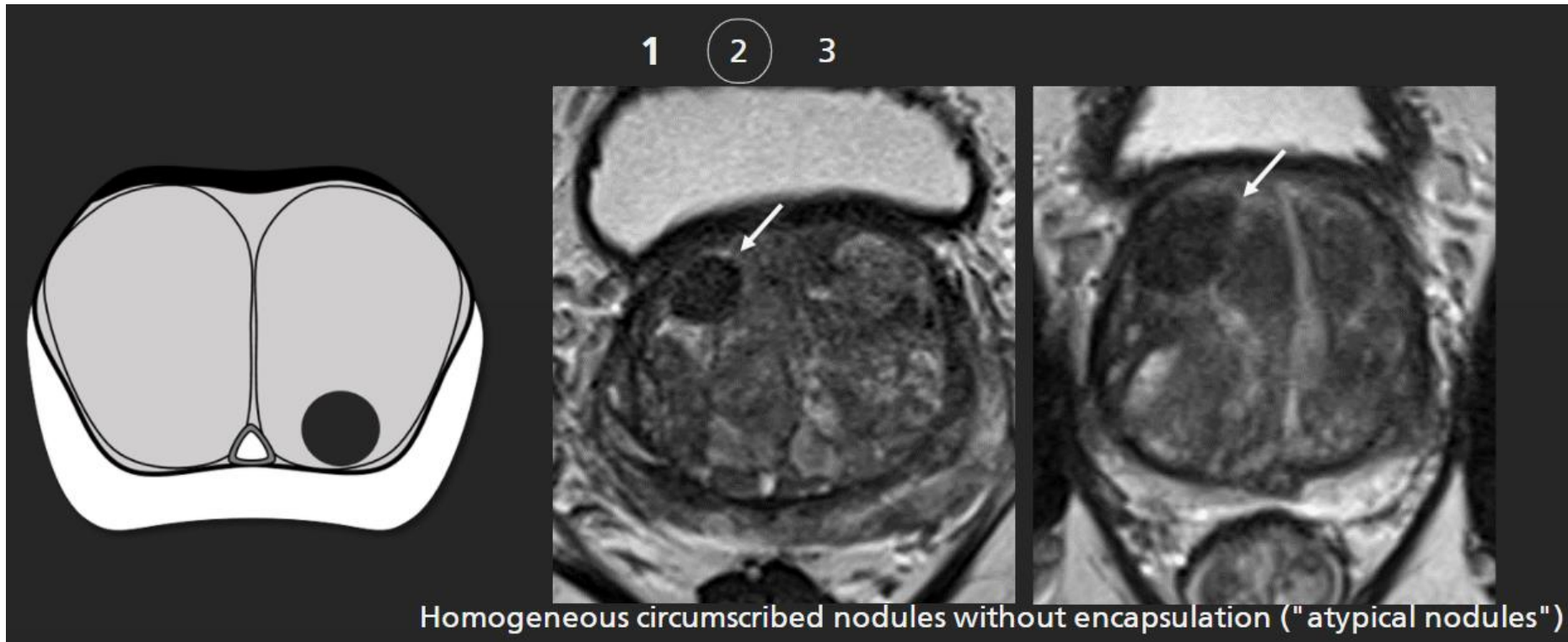
Score	Transition Zone T2W criteria
1	Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")



Score	Transition Zone T2W criteria
2	A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules



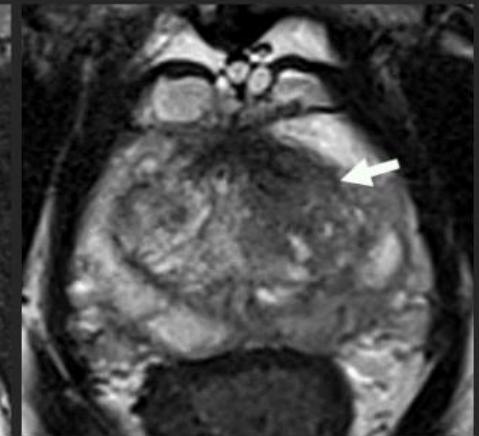
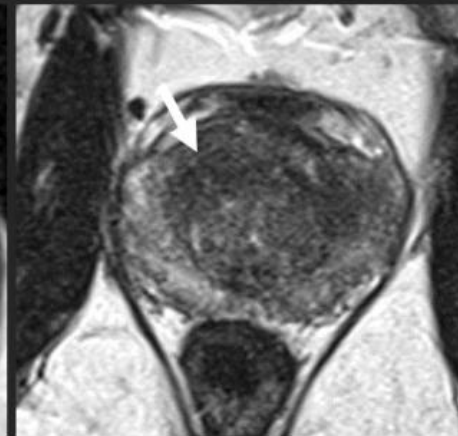
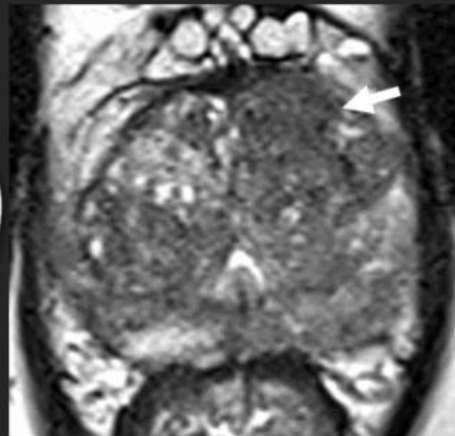
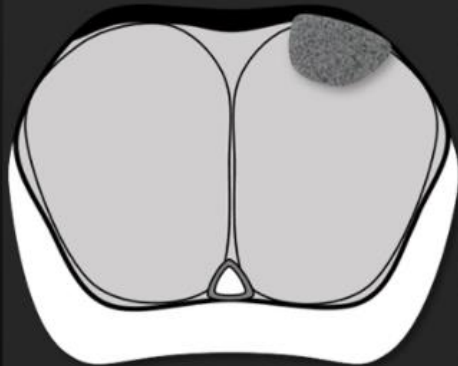
Score	Transition Zone T2W criteria
2	A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules



Score	Transition Zone T2W criteria
2	A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules

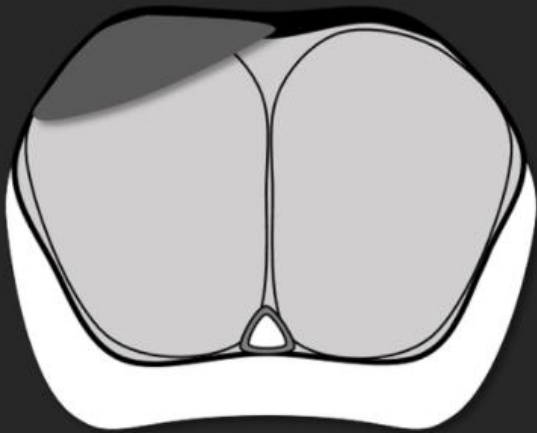


Score	Transition Zone T2W criteria
3	Heterogeneous signal intensity with obscured margins. Includes others that do not qualify as 2, 4, or 5

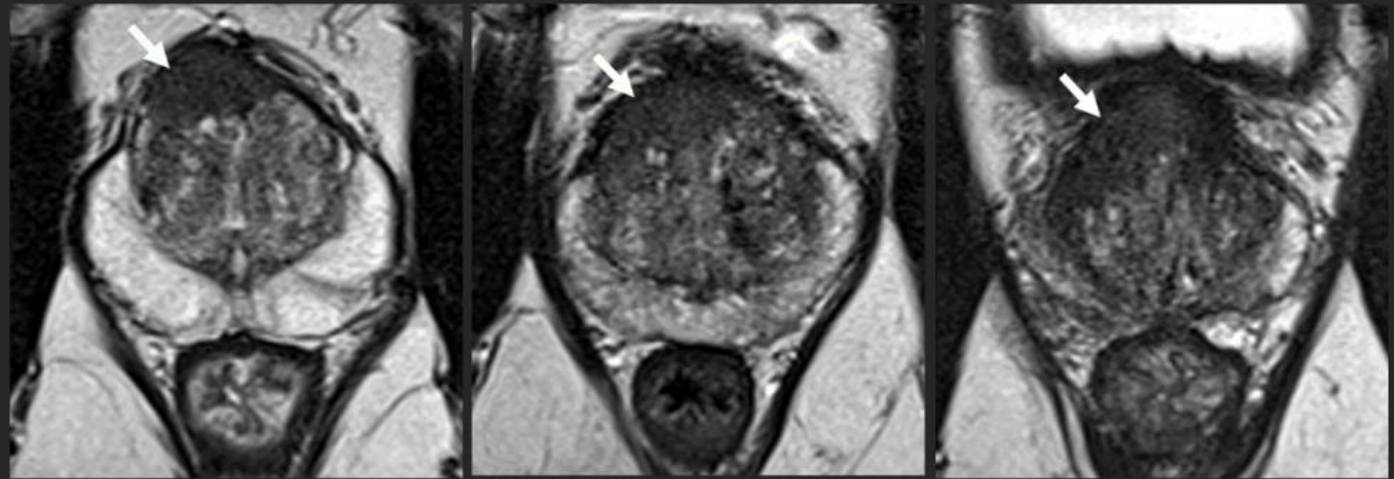
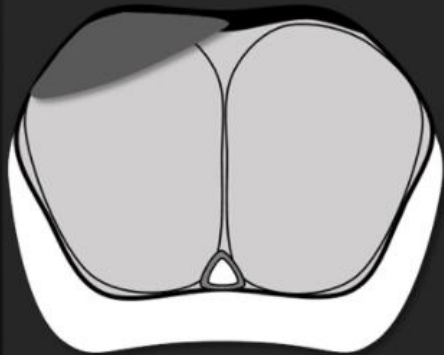




Score	Transition Zone T2W criteria
4	Lenticular or non-circumscribed, homogeneous, moderately hypointense, and < 1.5 cm in greatest dimension



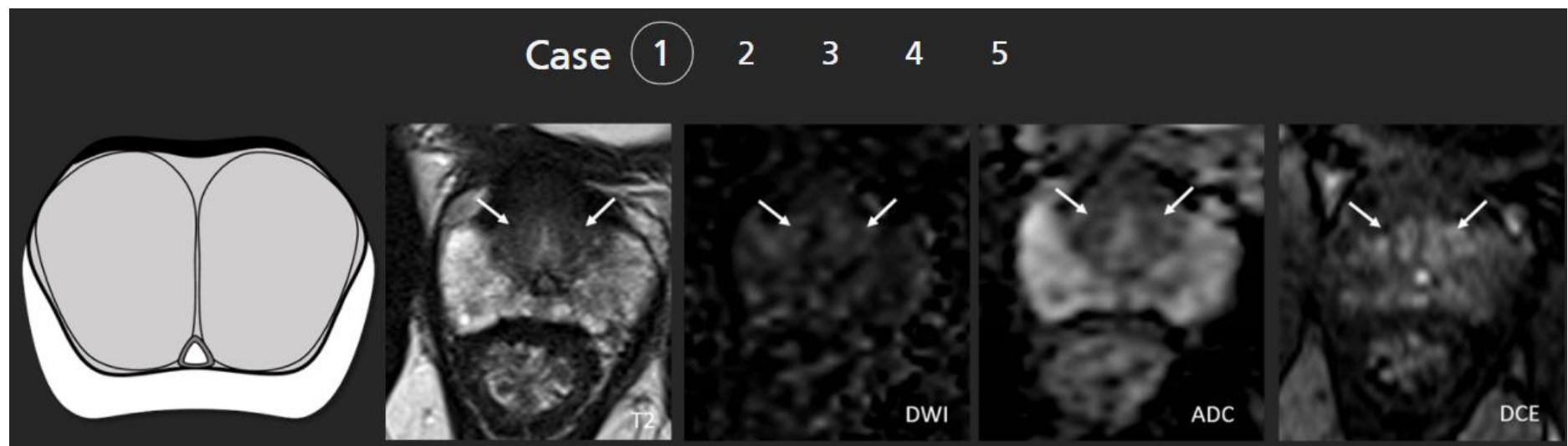
Score	Transition Zone T2W criteria
5	Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior



Select the PI-RADS assessment category to see MRI examples

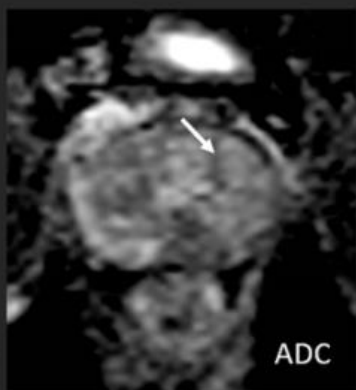
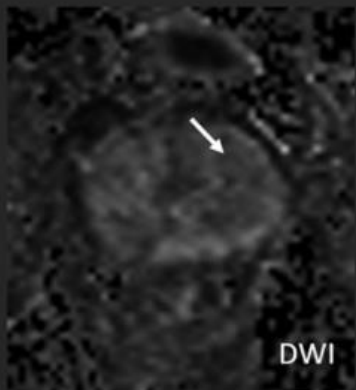
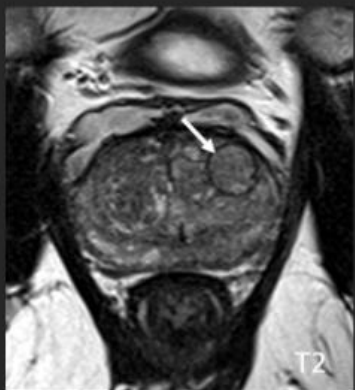
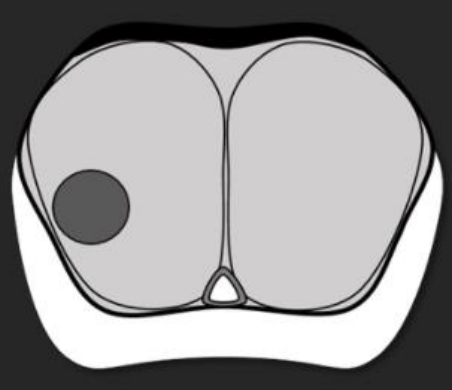
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")	1	N/A	1 (Highly unlikely)
A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules	2	< 4	2 (Unlikely)
		≥ 4	3 (Equivocal)
Heterogeneous signal intensity with obscured margins Includes others that do not qualify as 2, 4, or 5	3	< 5	3 (Equivocal)
		5	4 (Likely)
Lenticular or non-circumscribed, homogeneous, moderately hypointense, and < 1.5 cm in greatest dimension	4	N/A	4 (Likely)
Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	5 (Highly likely)

Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")	1	N/A	1 (Highly unlikely)



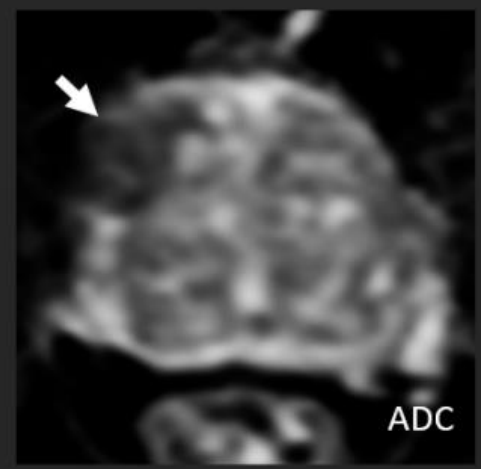
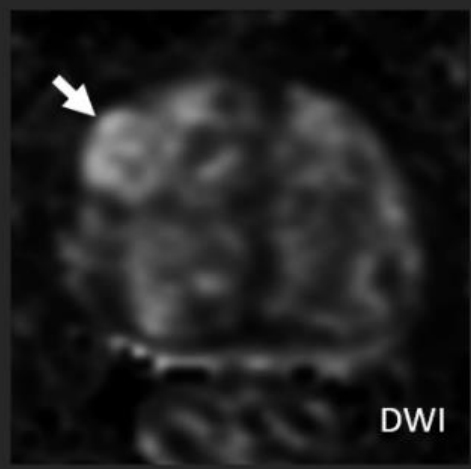
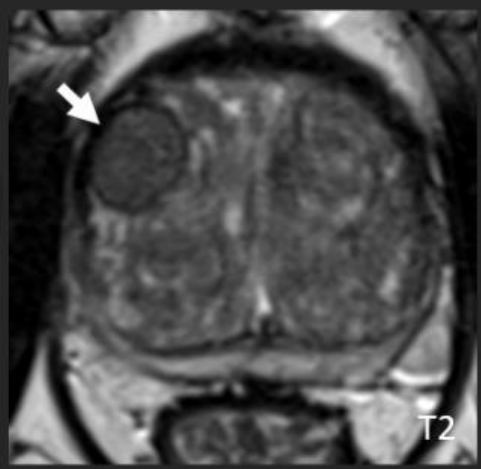
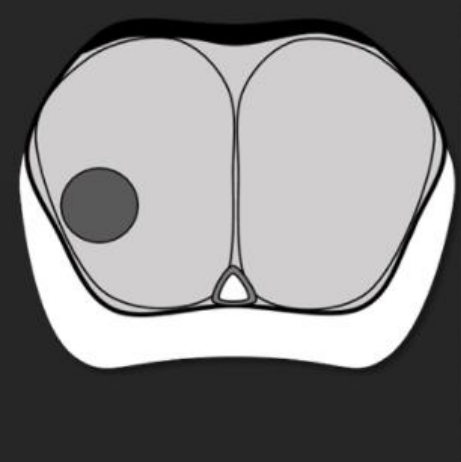
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")	1	N/A	1 (Highly unlikely)

Case 1 2 3 4 5



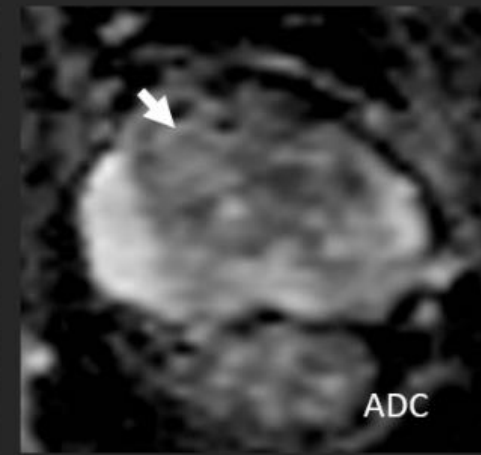
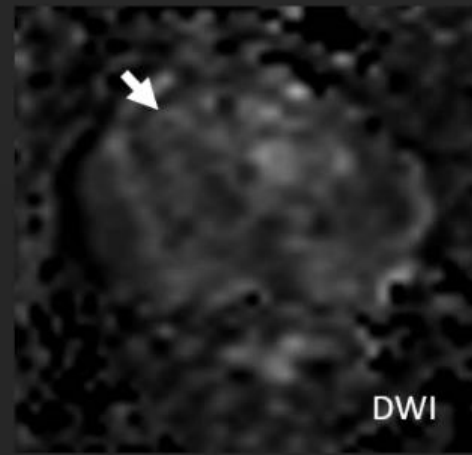
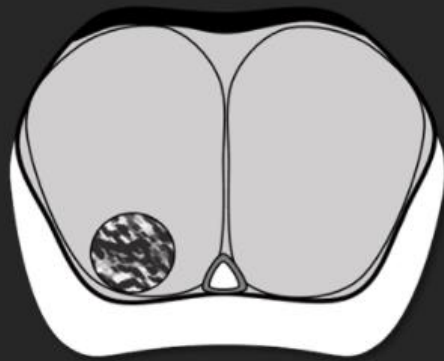
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")	1	N/A	1 (Highly unlikely)

Case 1 2 **3** 4 5



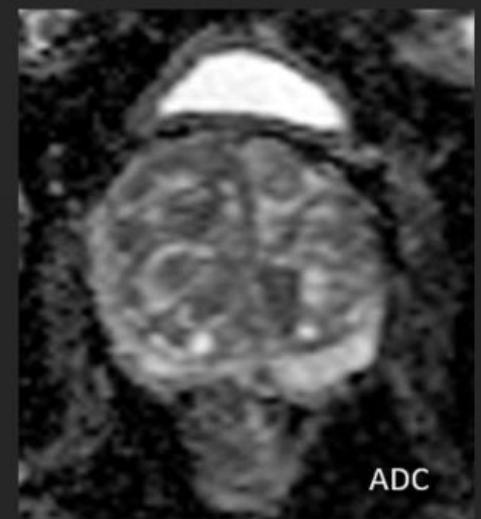
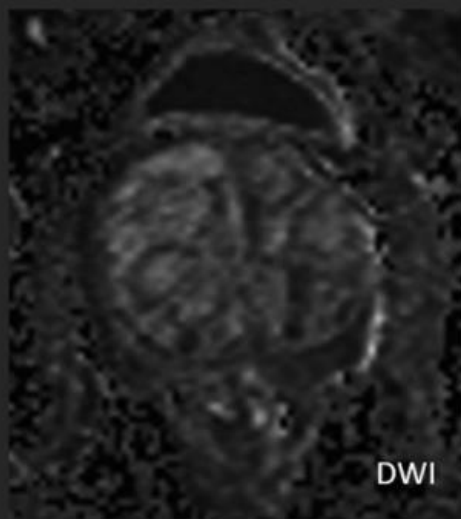
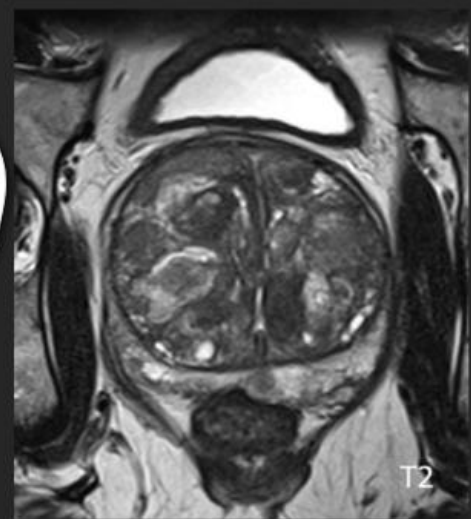
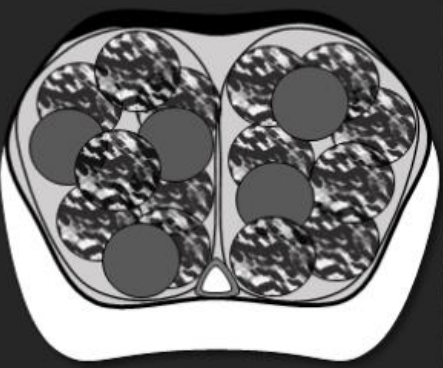
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")	1	N/A	1 (Highly unlikely)

Case 1 2 3 4 5



Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Normal appearing TZ (rare) or a round, completely encapsulated nodule ("typical nodule")	1	N/A	1 (Highly unlikely)

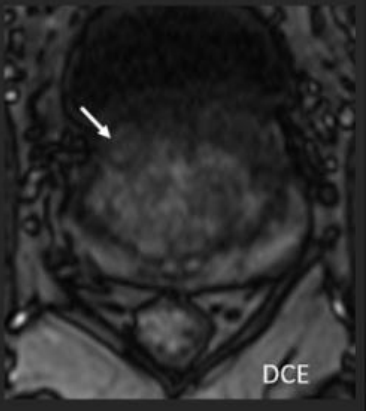
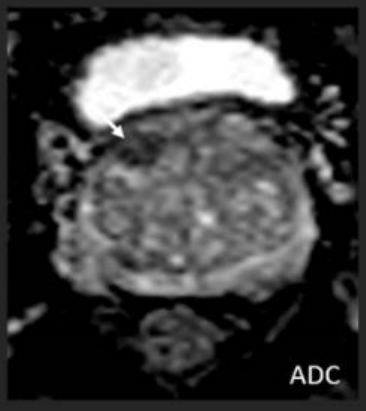
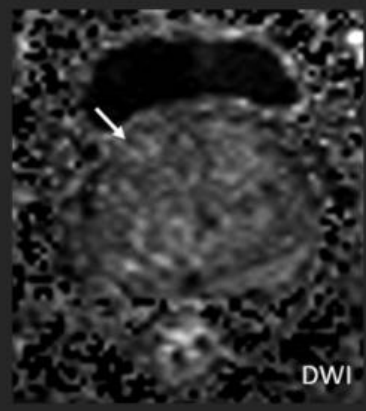
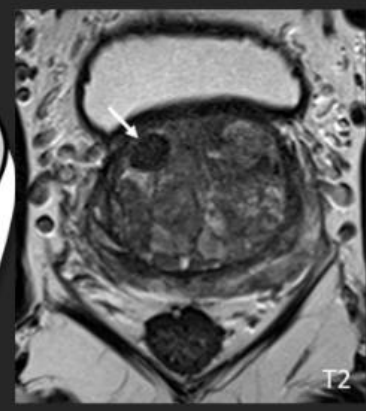
Case 1 2 3 4 5



Multiple nodules with similar appearance. None of these nodules stand out against the background.

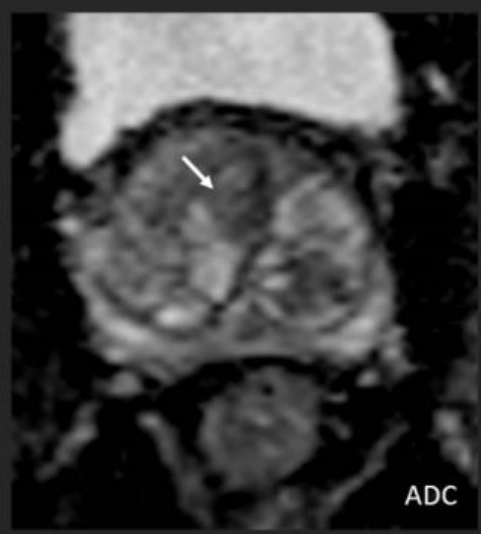
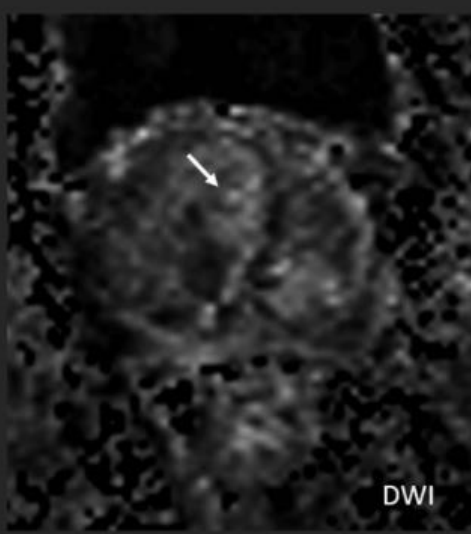
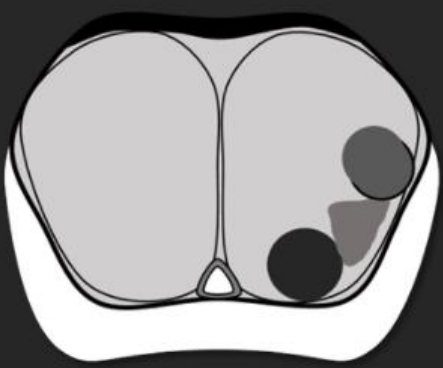
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules	2	< 4	2 (Unlikely)

Case 1 2 3



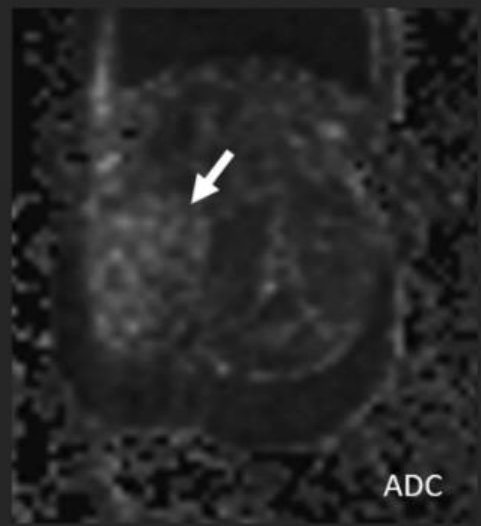
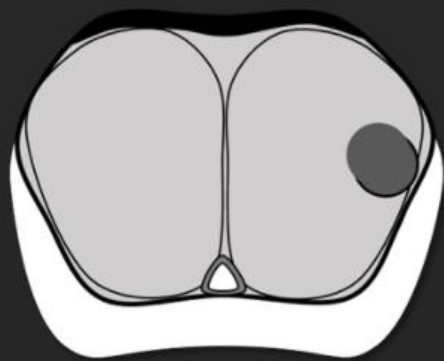
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules	2	< 4	2 (Unlikely)

Case 1 (2) 3



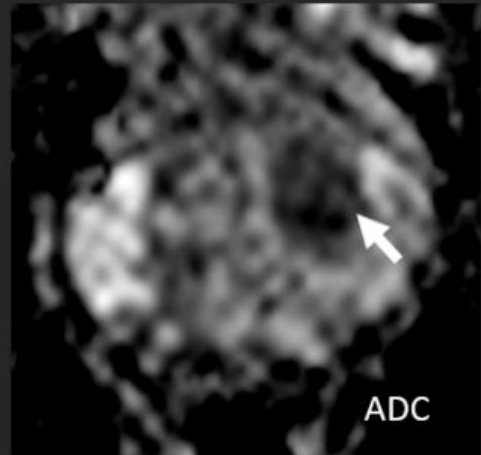
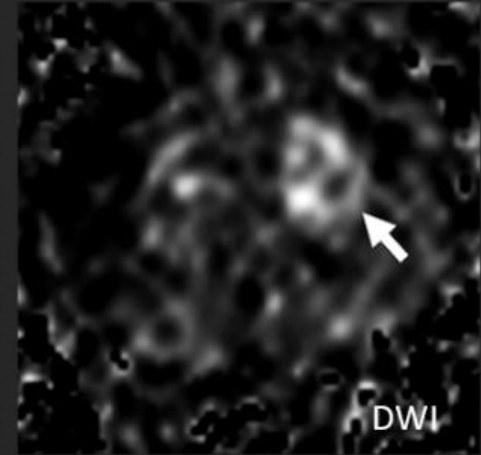
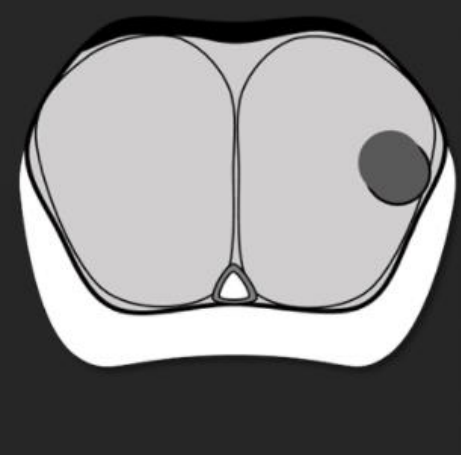
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules	2	< 4	2 (Unlikely)

Case 1 2 3



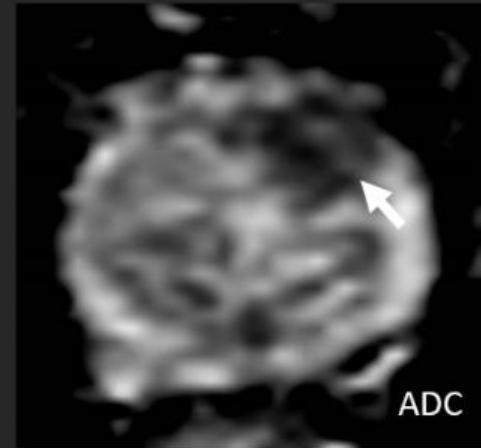
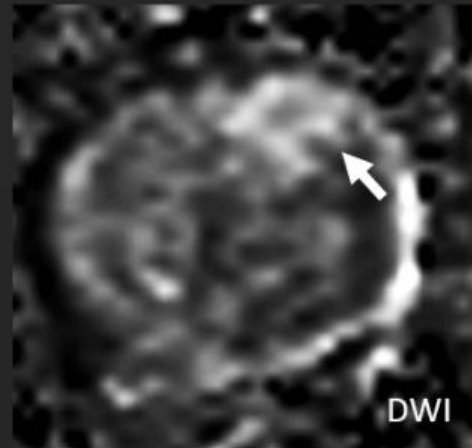
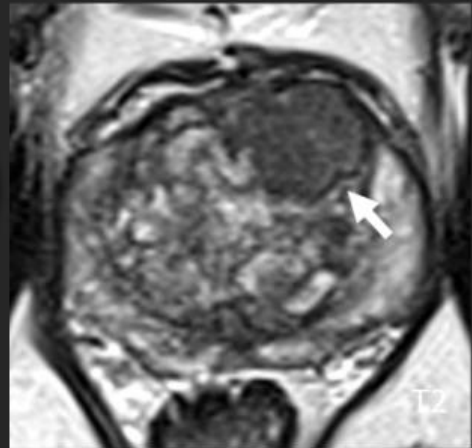
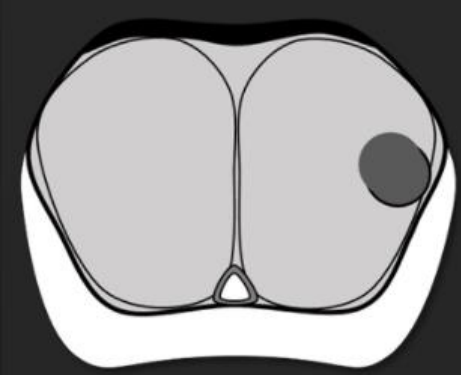
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules	2	≥ 4	3 (Equivocal)

Case 1 2



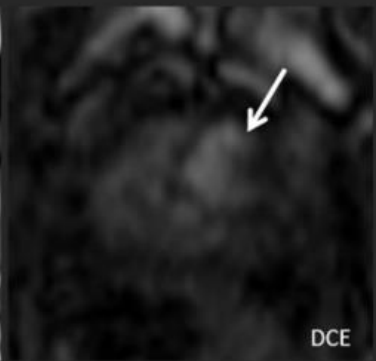
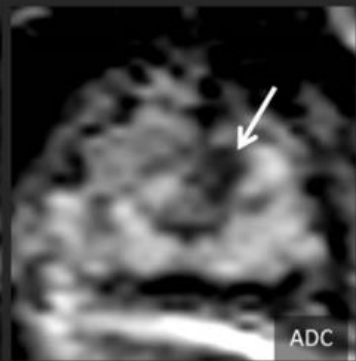
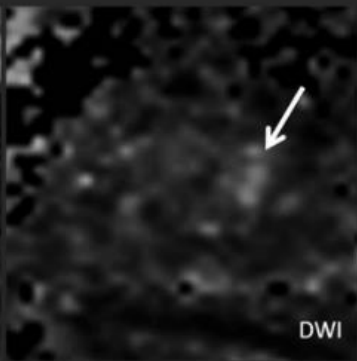
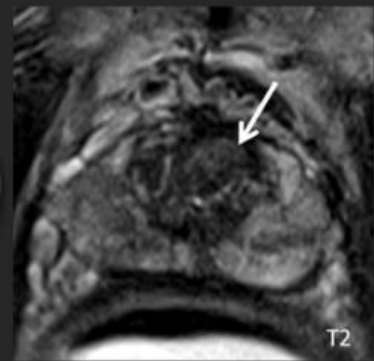
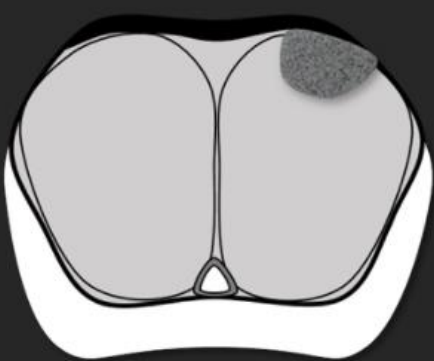
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
A mostly encapsulated nodule OR a homogeneous circumscribed nodule without encapsulation ("atypical nodule") OR a homogeneous mildly hypointense area between nodules	2	≥ 4	3 (Equivocal)

Case 1 2



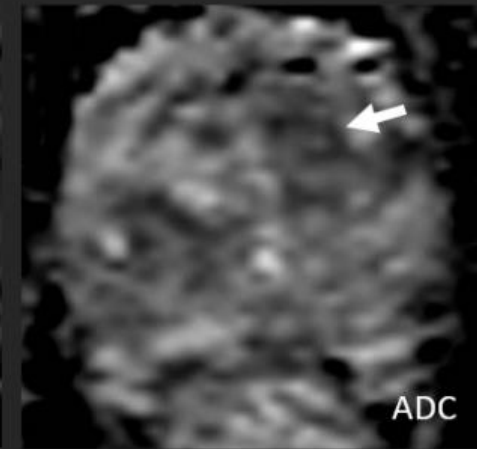
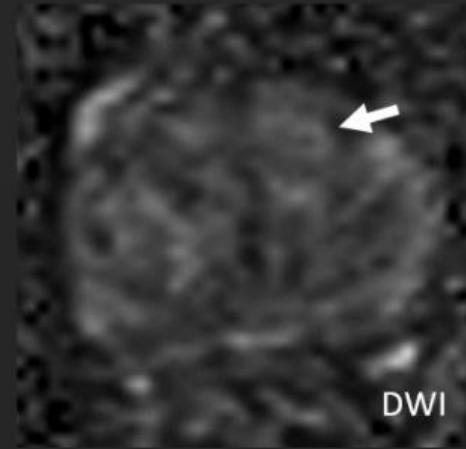
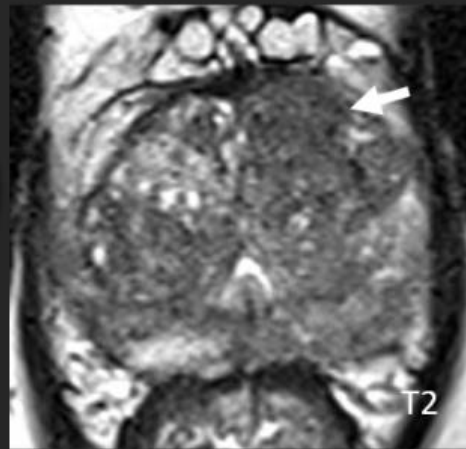
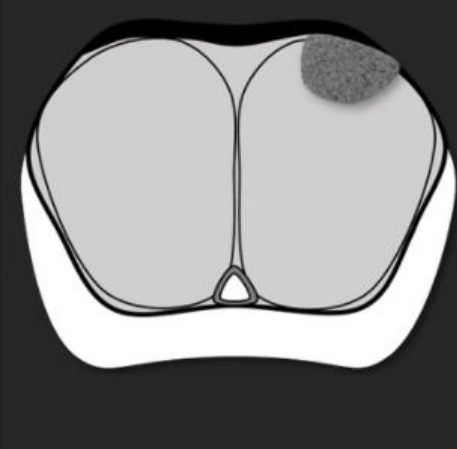
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Heterogeneous signal intensity with obscured margins Includes others that do not qualify as 2, 4, or 5	3	< 5	3 (Equivocal)

Case **1** 2 3



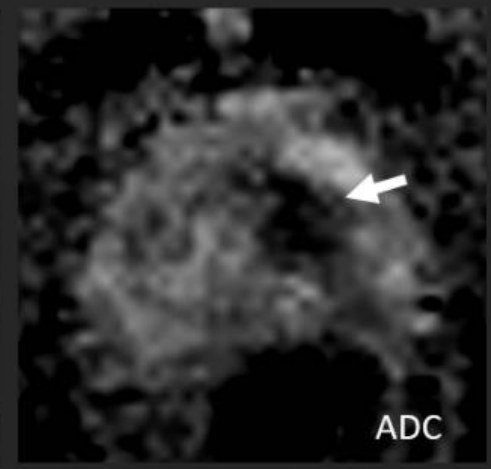
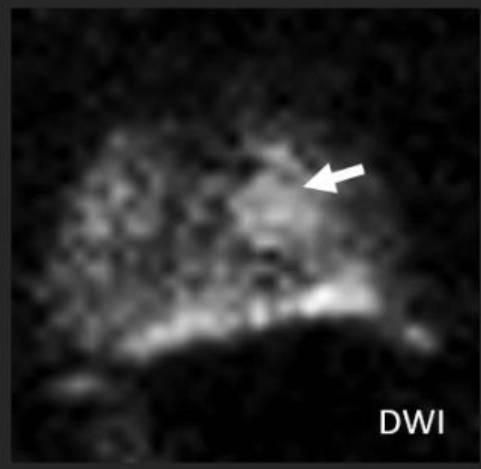
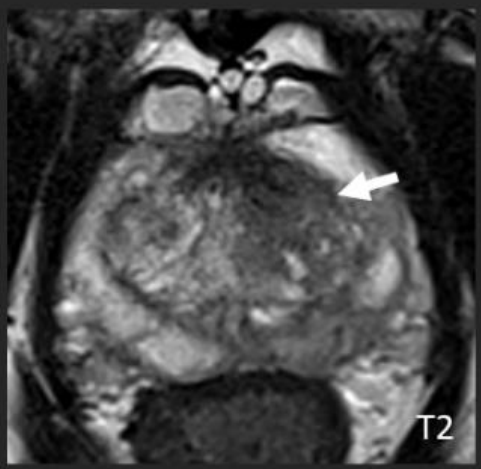
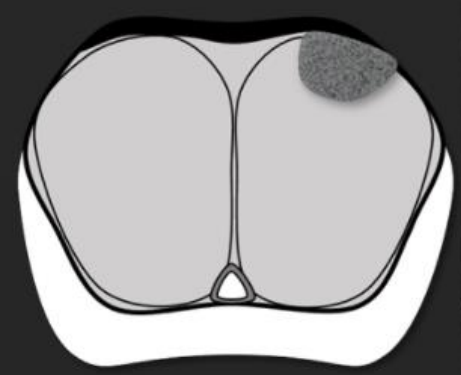
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Heterogeneous signal intensity with obscured margins Includes others that do not qualify as 2, 4, or 5	3	< 5	3 (Equivocal)

Case 1 2 3



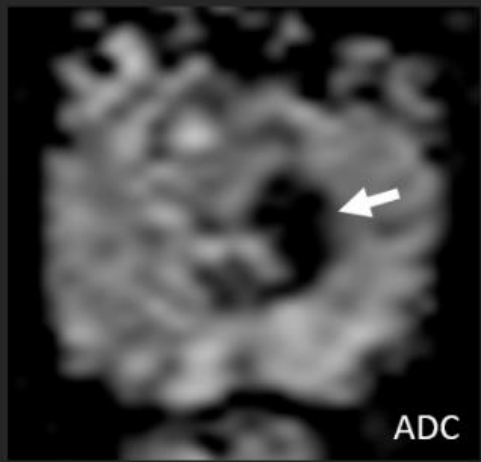
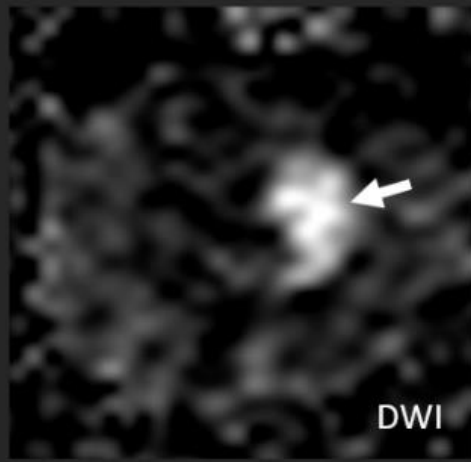
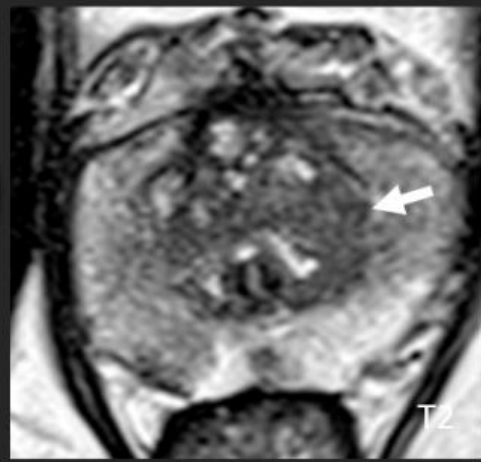
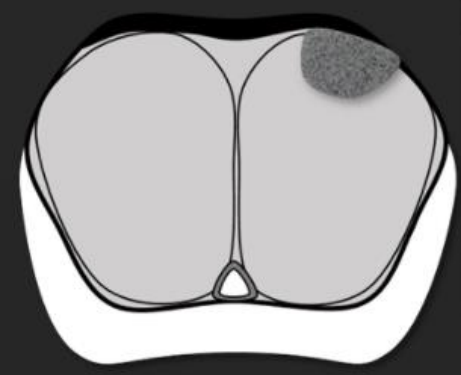
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Heterogeneous signal intensity with obscured margins Includes others that do not qualify as 2, 4, or 5	3	< 5	3 (Equivocal)

Case 1 2 **3**



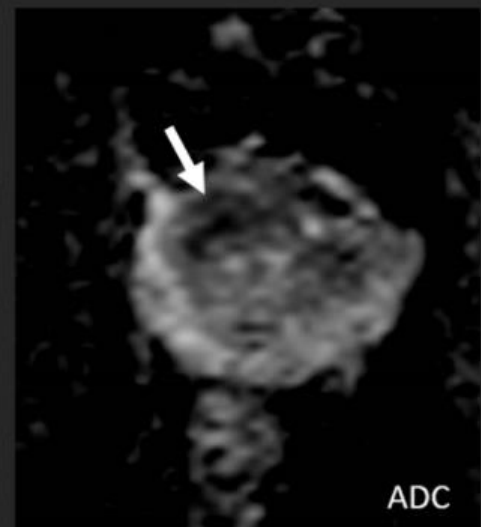
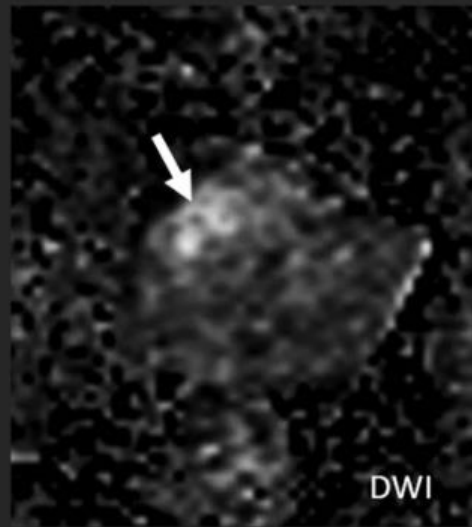
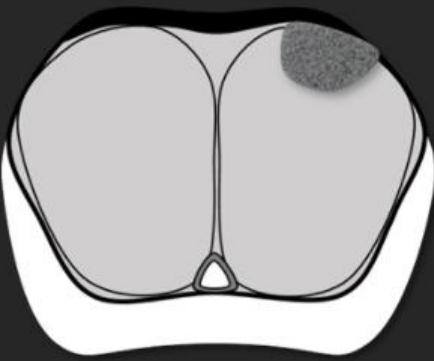
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa*)
Heterogeneous signal intensity with obscured margins Includes others that do not qualify as 2, 4, or 5	3	5	4 (Likely)

Case 1 2



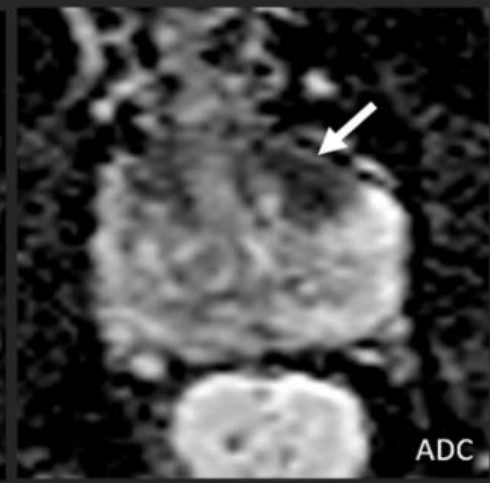
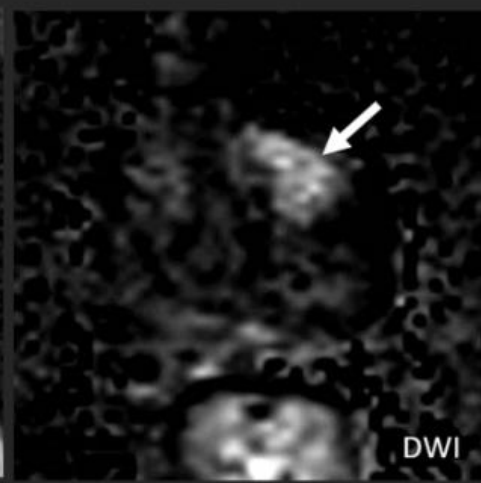
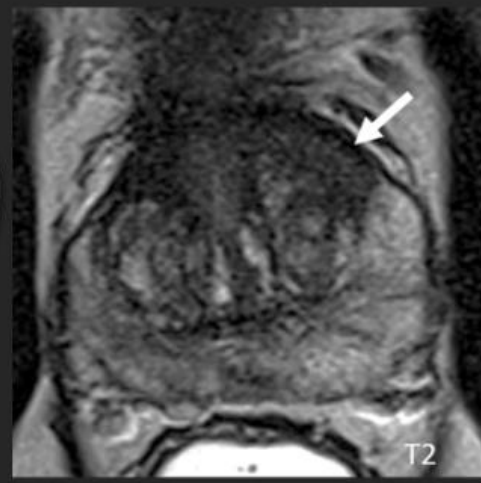
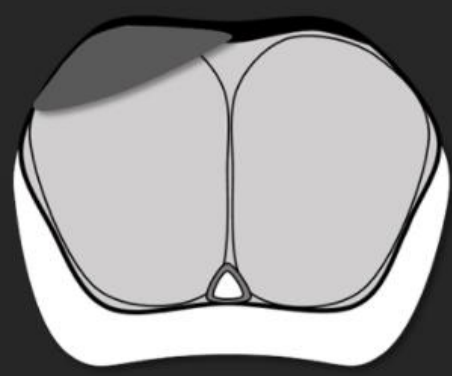
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa*)
Heterogeneous signal intensity with obscured margins Includes others that do not qualify as 2, 4, or 5	3	5	4 (Likely)

Case 1 2



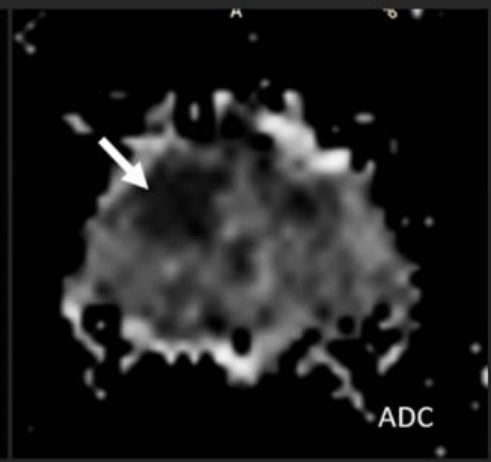
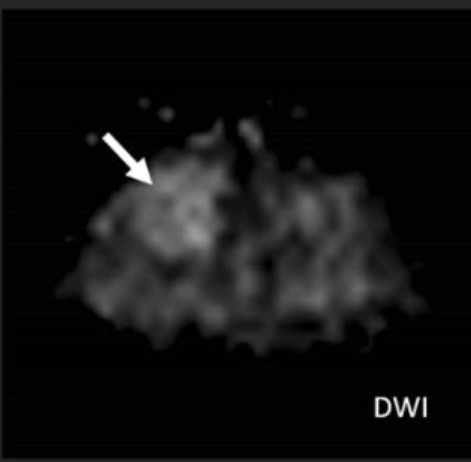
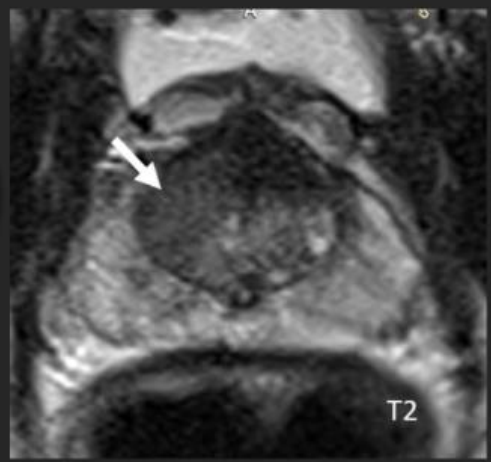
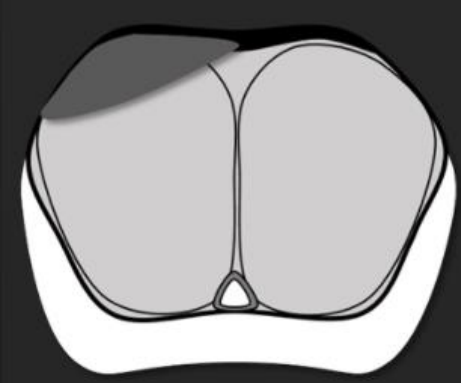
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Lenticular or non-circumscribed, homogeneous, moderately hypointense, and < 1.5 cm in greatest dimension	4	N/A	4 (Likely)

Case 1 2



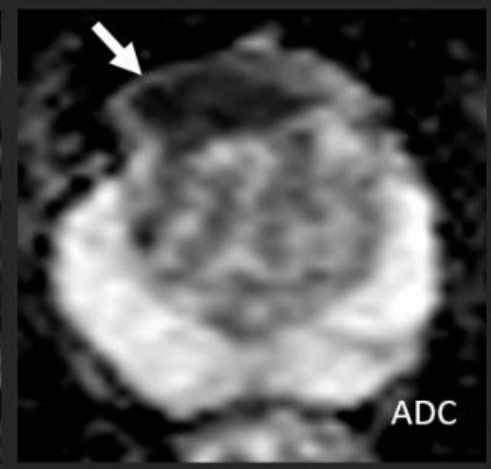
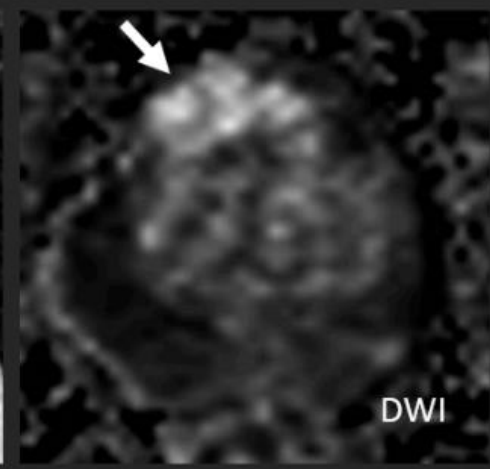
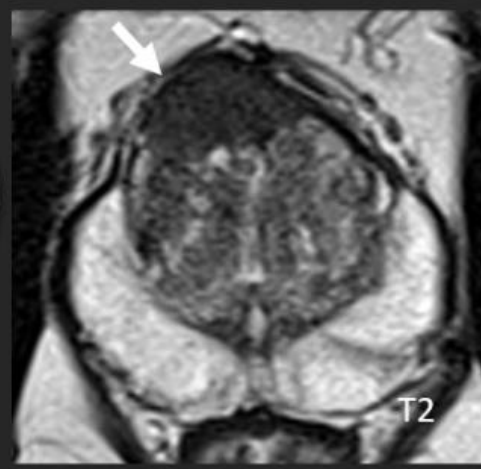
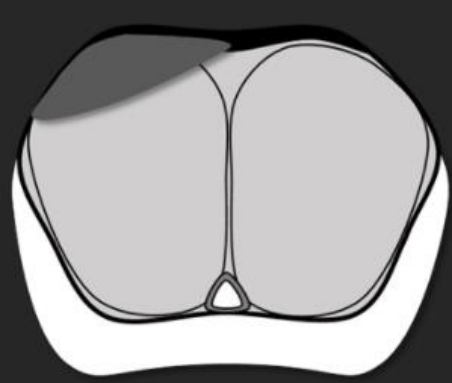
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Lenticular or non-circumscribed, homogeneous, moderately hypointense, and < 1.5 cm in greatest dimension	4	N/A	4 (Likely)

Case 1 (2)



Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	5 (Highly likely)

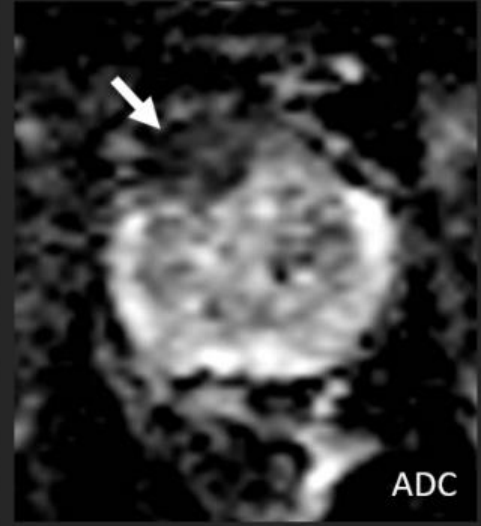
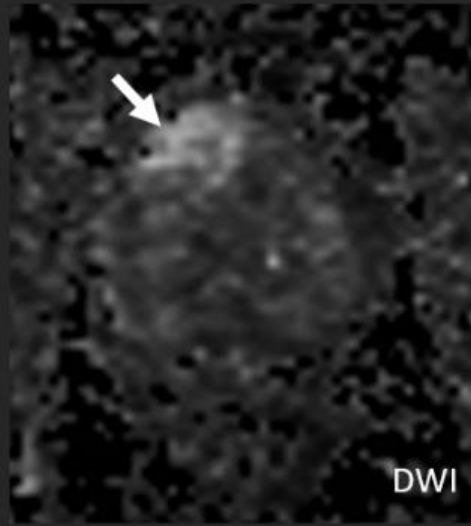
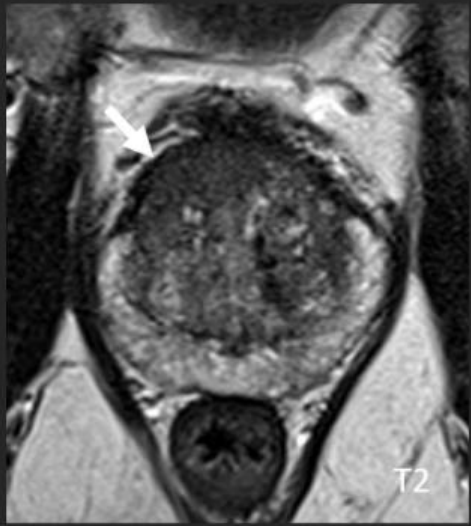
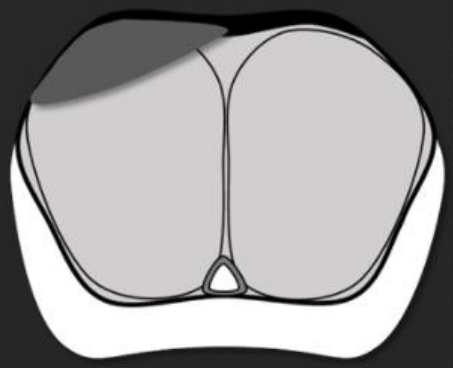
Case 1 2 3 4 5



Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
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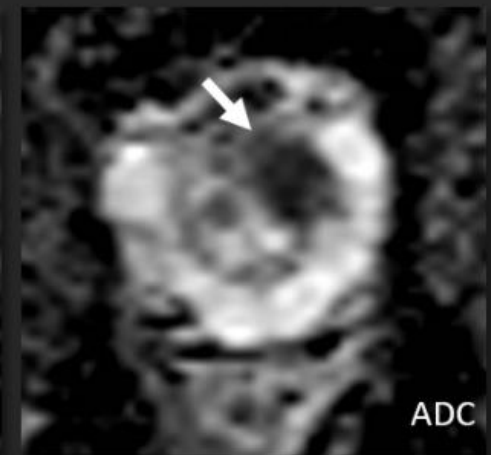
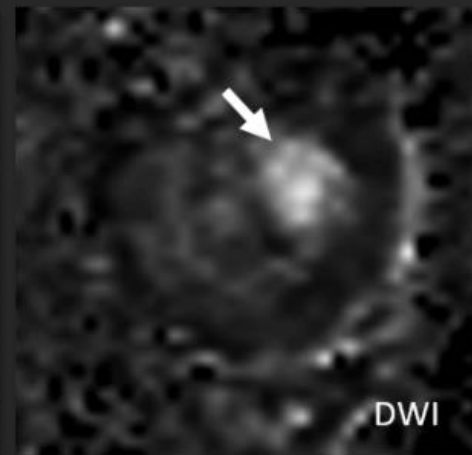
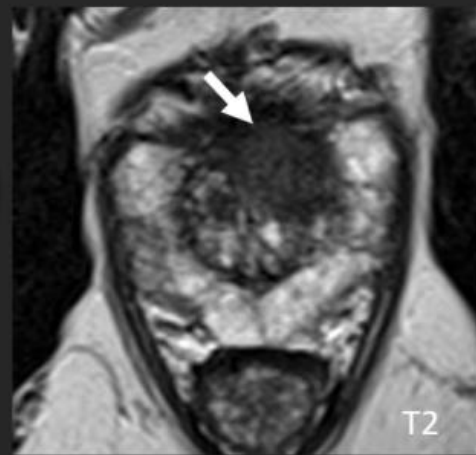
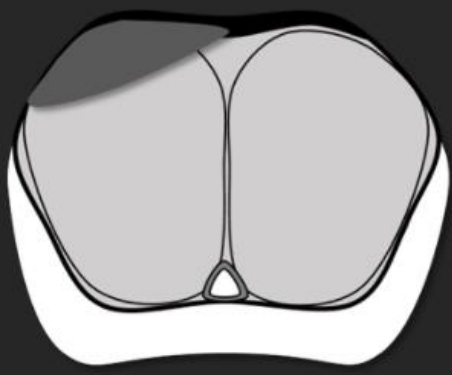
Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	5 (Highly likely)
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Case 1 (2) 3 4 5



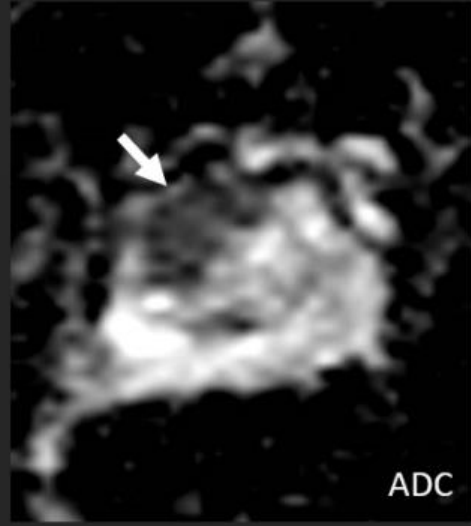
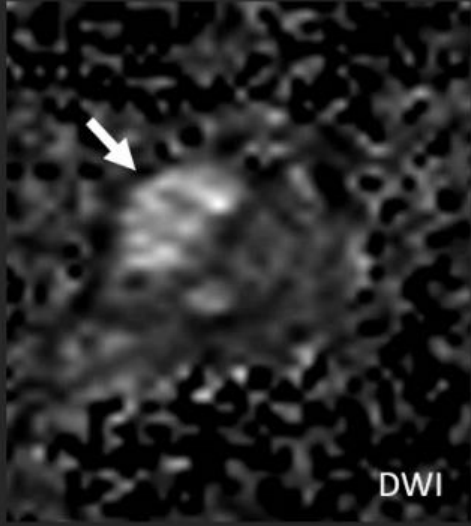
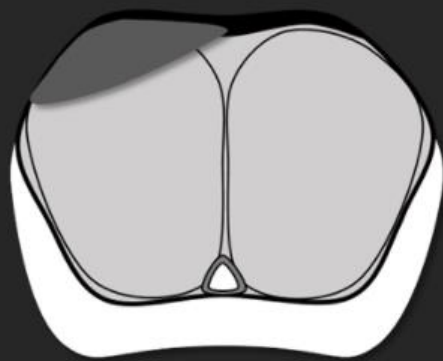
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	5 (Highly likely)

Case 1 2 **3** 4 5



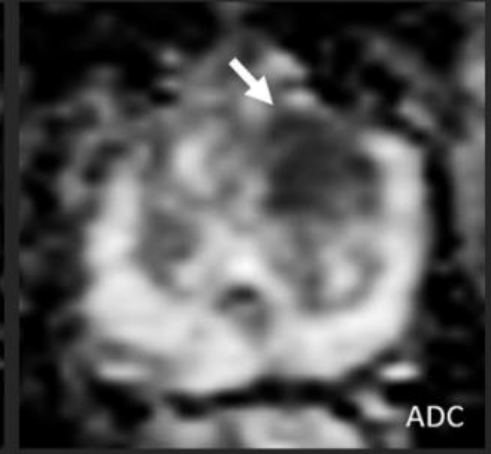
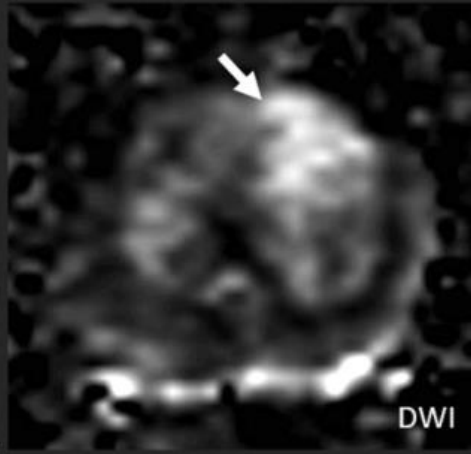
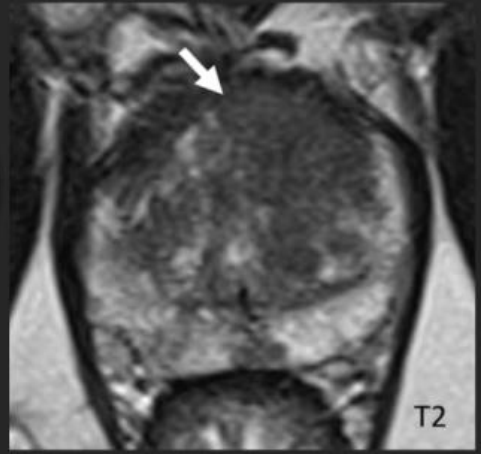
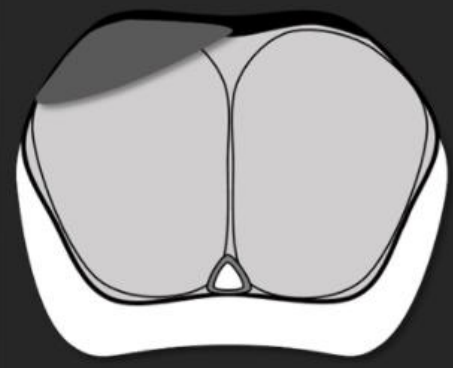
Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	5 (Highly likely)

Case 1 2 3 4 5



Transition Zone (TZ) Dominant parameter: T2WI	T2WI Score	Ancillary parameter DWI	PI-RADS assessment category (likelihood of csPCa)
Same as 4, but ≥ 1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior	5	N/A	5 (Highly likely)

Case 1 2 3 4 5



PI-RADS 4 & 5

PI-RADS 3
(PI-RADS 4 if
DWI score 5)

High b-value DWI

ADC

≥ 1.5 cm, EPE or,
invasive behavior

PI-RADS 1

PI-RADS 2
(PI-RADS 3
if DWI score
≥ 4)

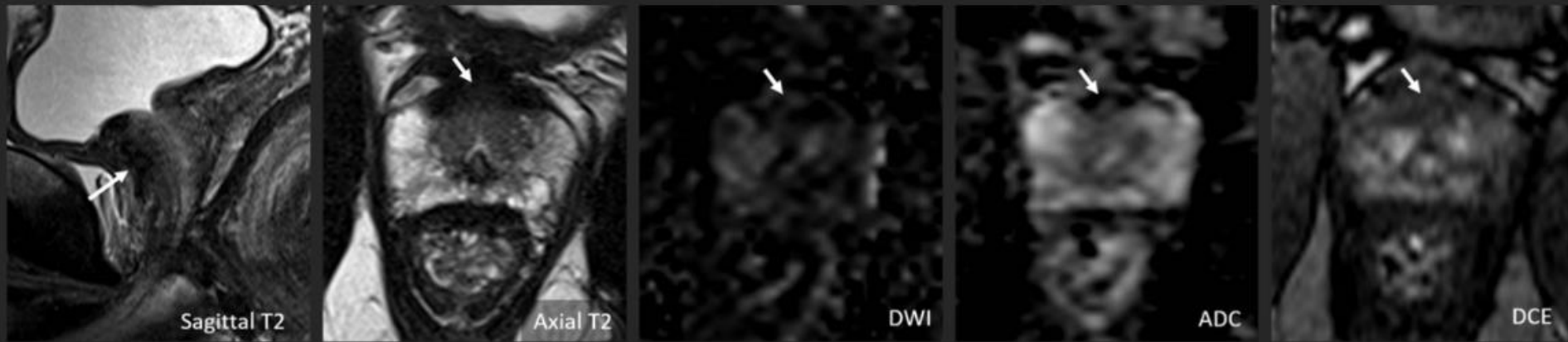
High b-value DWI

ADC

Citation: Purysko AS, Rosenkrantz AB, Turkbey IB, Macura KJ. RadioGraphics Update: PI-RADS Version 2.1-A Pictorial Update. Radiographics. 2020 Nov-Dec;40(7):E33-E37. doi: 10.1148/rg.2020190207. PMID: 33136475

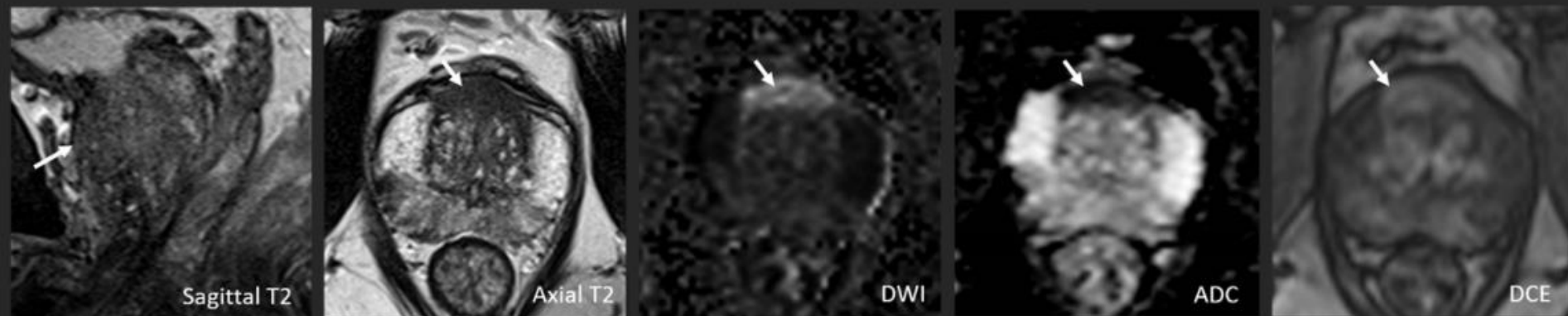
- Since PCa does not originate in the AFS, when reporting a suspicious lesion in the AFS, criteria for either the PZ or TZ should be applied, depending on the zone from which the lesion appears to be originating.
- Abnormalities with increased T2W signal intensity relative to the pelvic muscles, with high signal intensity on high b-value DWI, low signal on ADC compared to adjacent pelvis muscle signal intensity (and hence relatively lower signal on ADC than normal AFS), asymmetric enlargement or focal mass, and early enhancement may all be helpful to detect PCa that has extended into the AFS.

Normal AFS



Normal AFS demonstrates low signal on T2WI, no restricted diffusion (i.e. low signal on DWI and ADC map) and no early arterial enhancement.

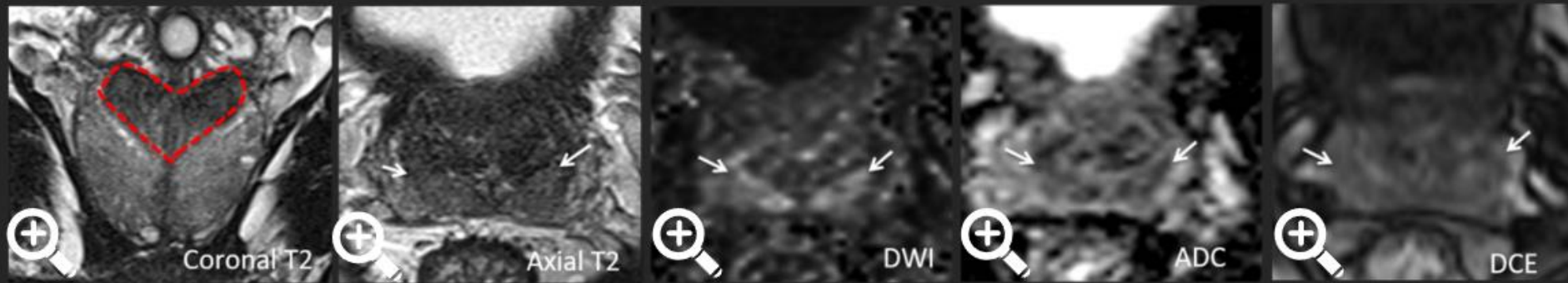
PCa involving AFS

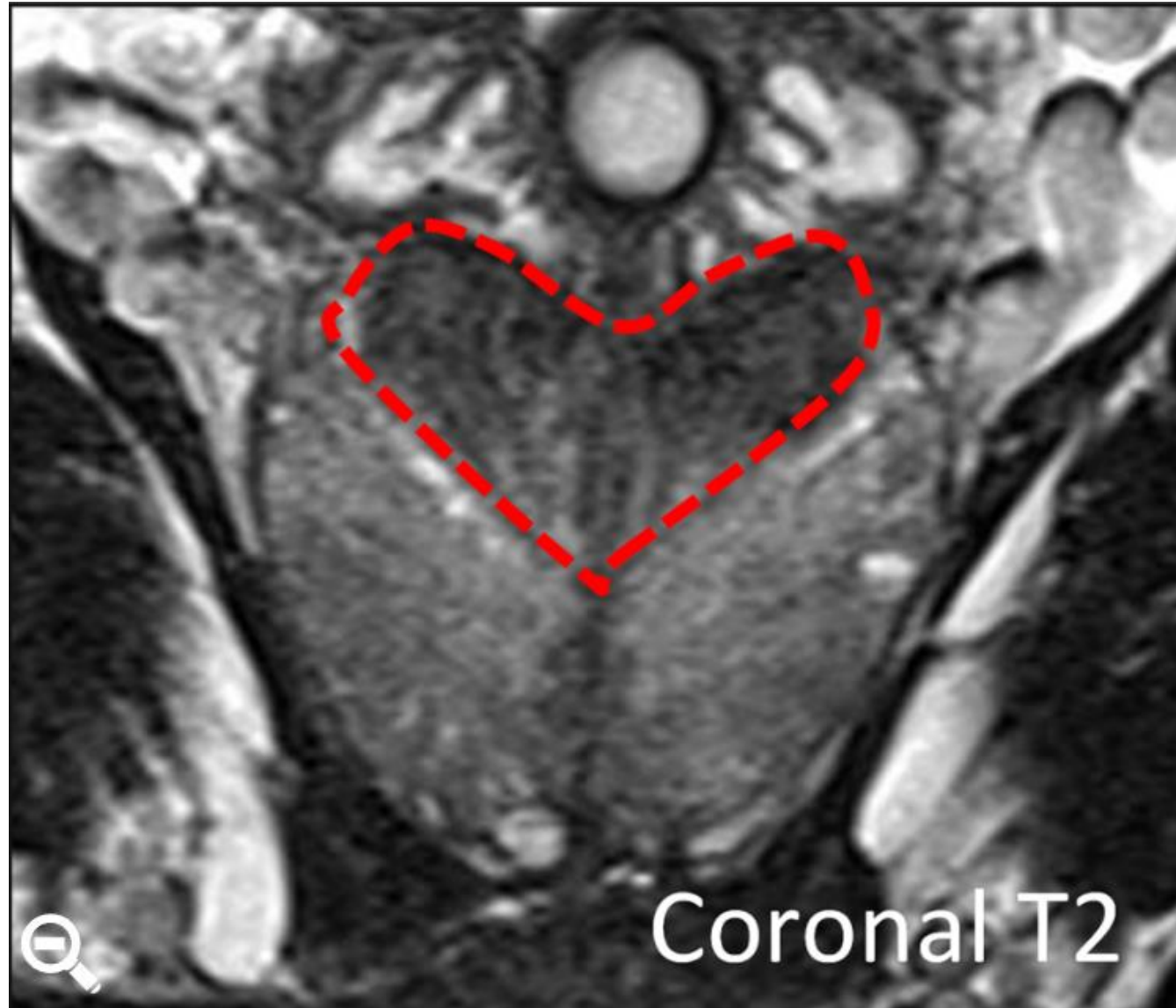


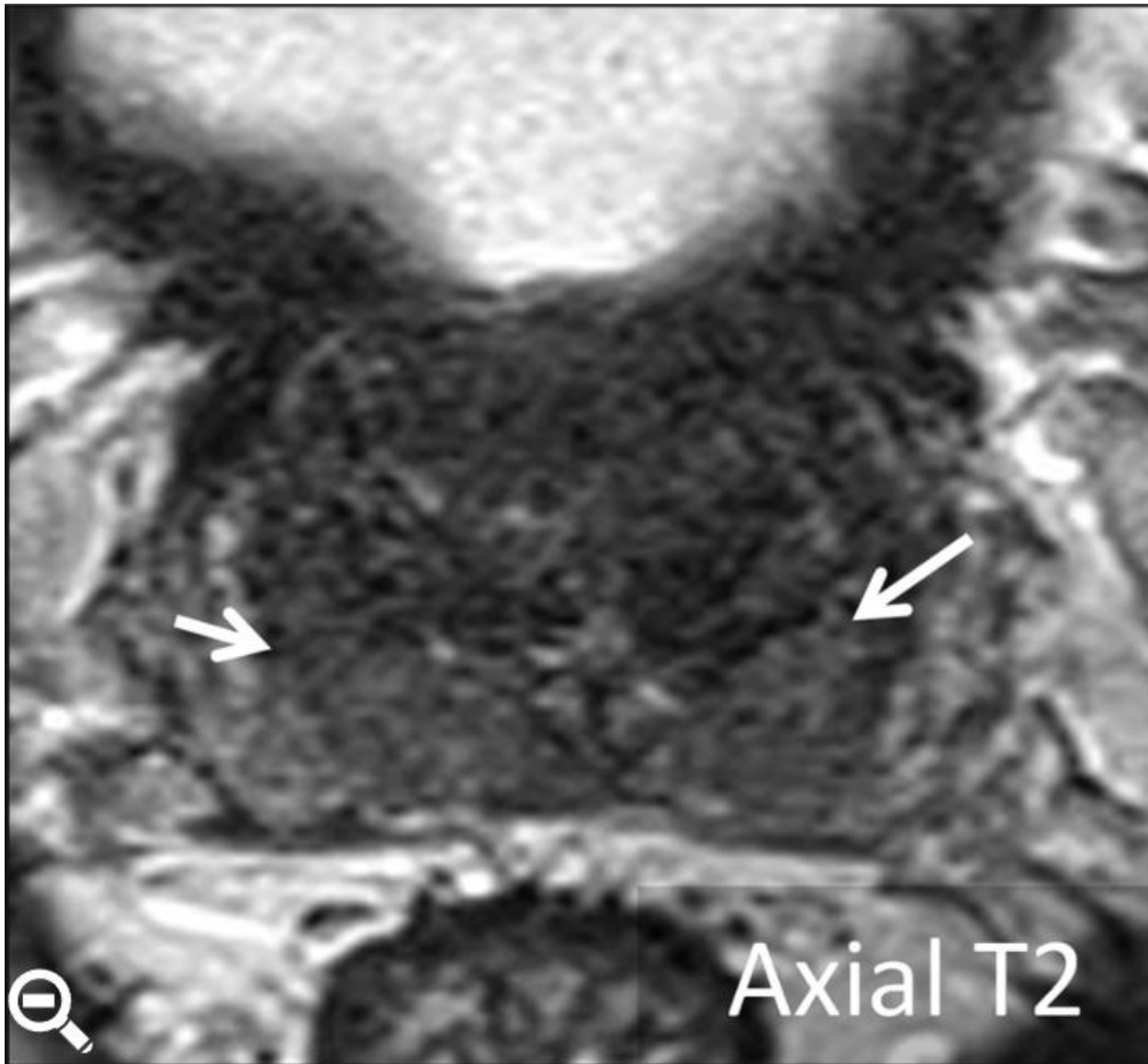
Cancer involving the anterior fibromuscular stroma. T2WI reveals a lesion with homogeneous low signal intensity in the anterior TZ obliterating the AFS. Unlike normal AFS, the lesion has high signal intensity on high b-value DWI, markedly low signal intensity on ADC map and early enhancement on DCE.

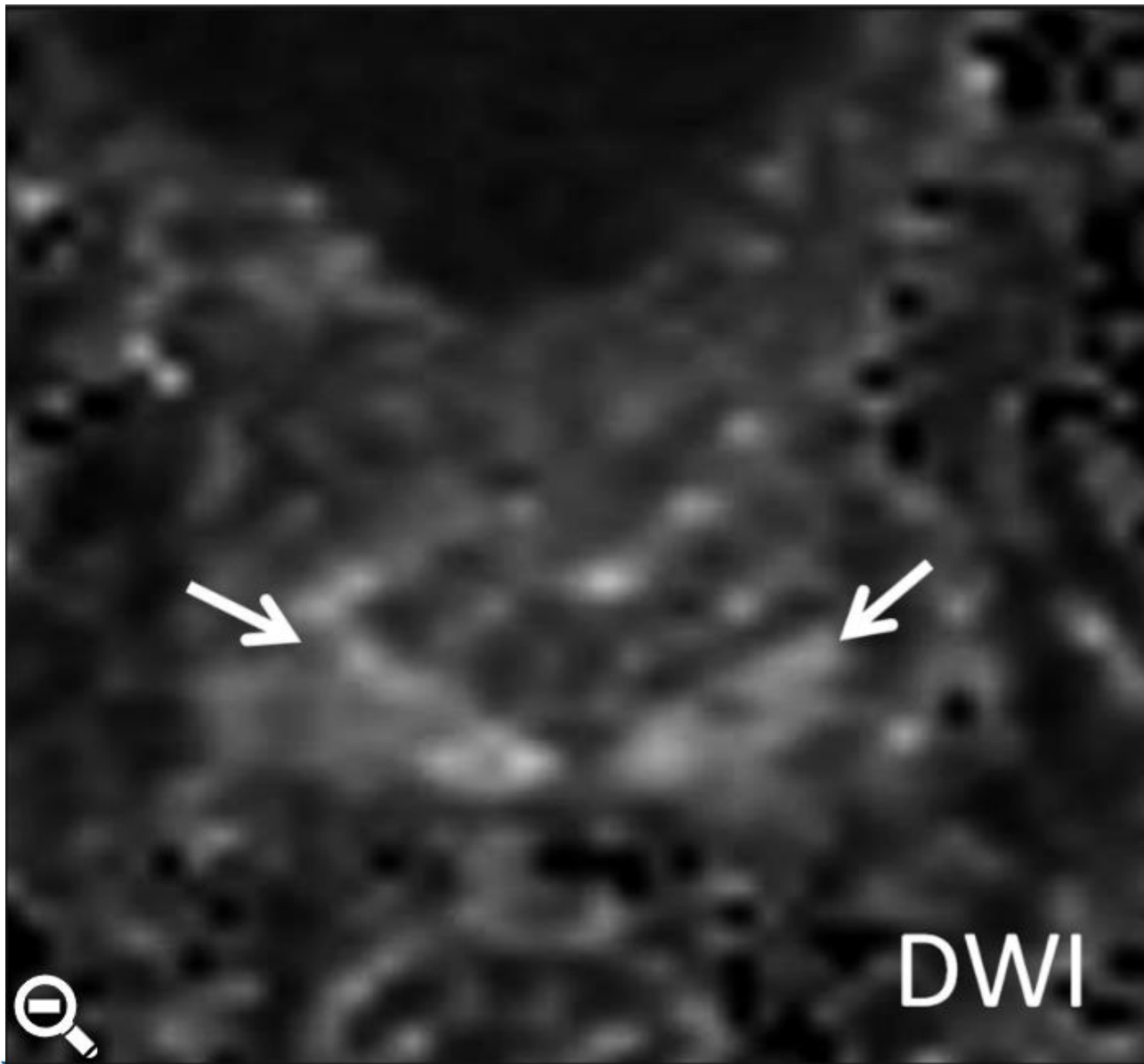
Normal appearance of CZ

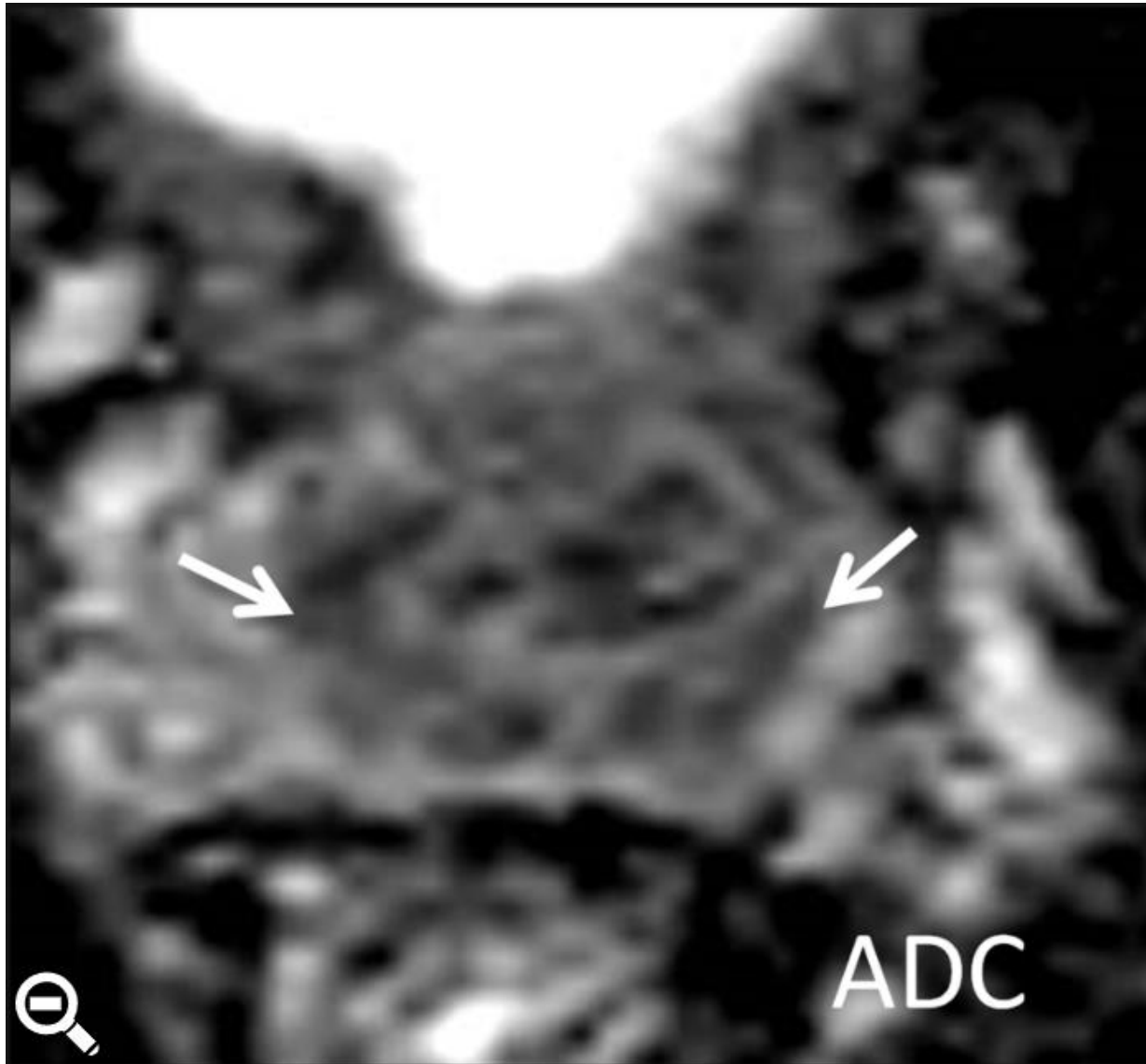
Coronal T2WI shows symmetric cone-shaped area with low signal intensity that extends from the base to the mid gland. Axial T2WI shows symmetric area with low signal intensity around the ejaculatory ducts. This area has symmetric mildly hyperintense signal on high b-value DWI and hypointense signal on ADC map. There is no early enhancement on DCE.

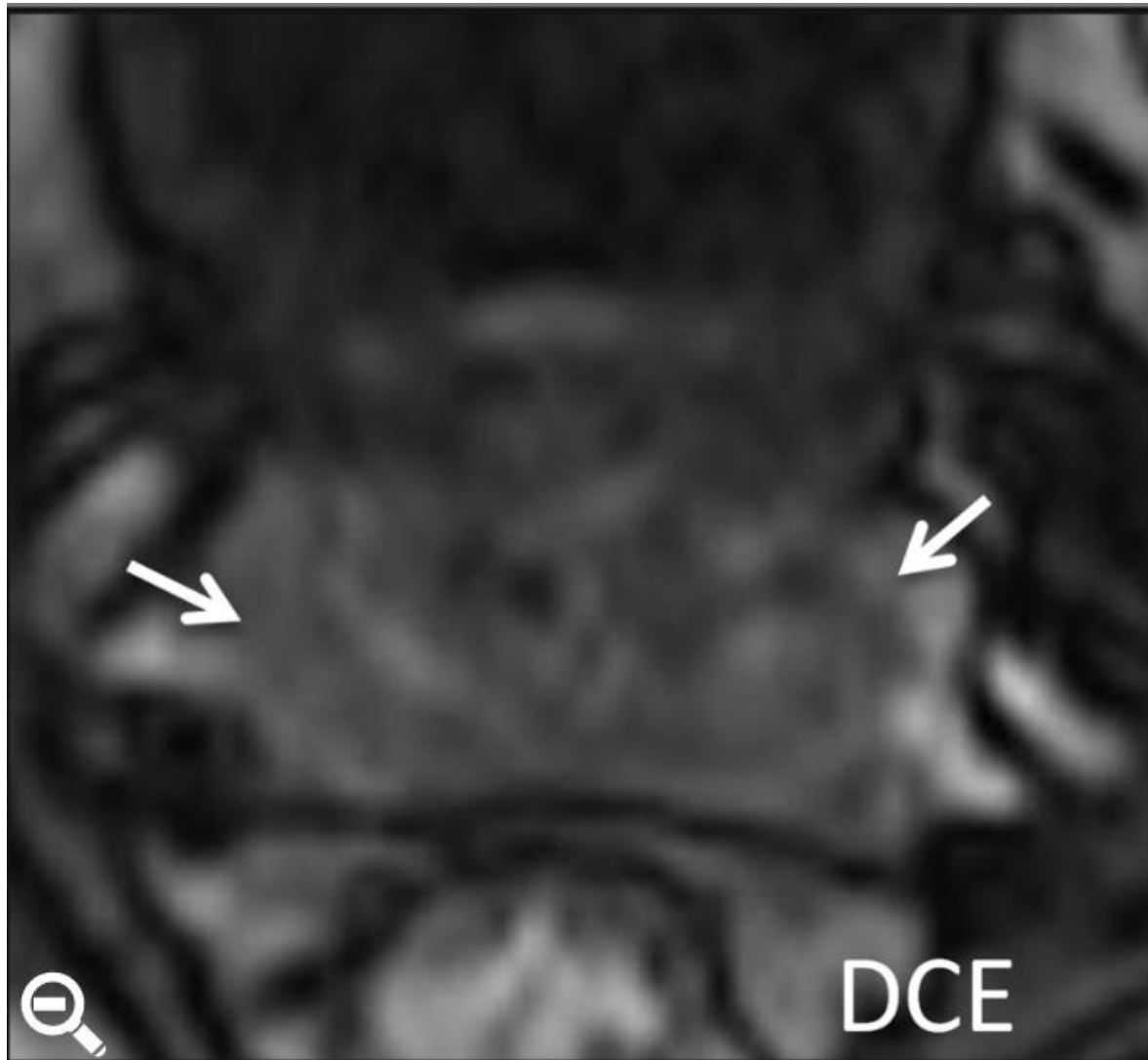






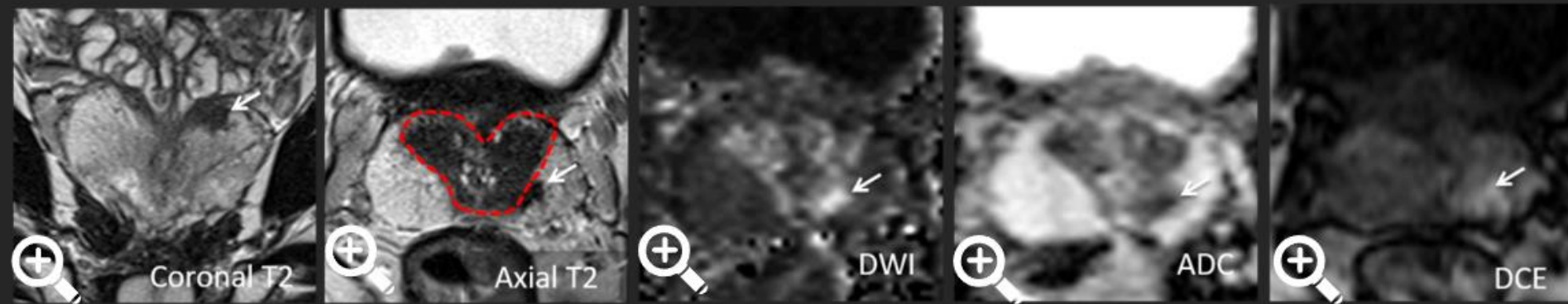


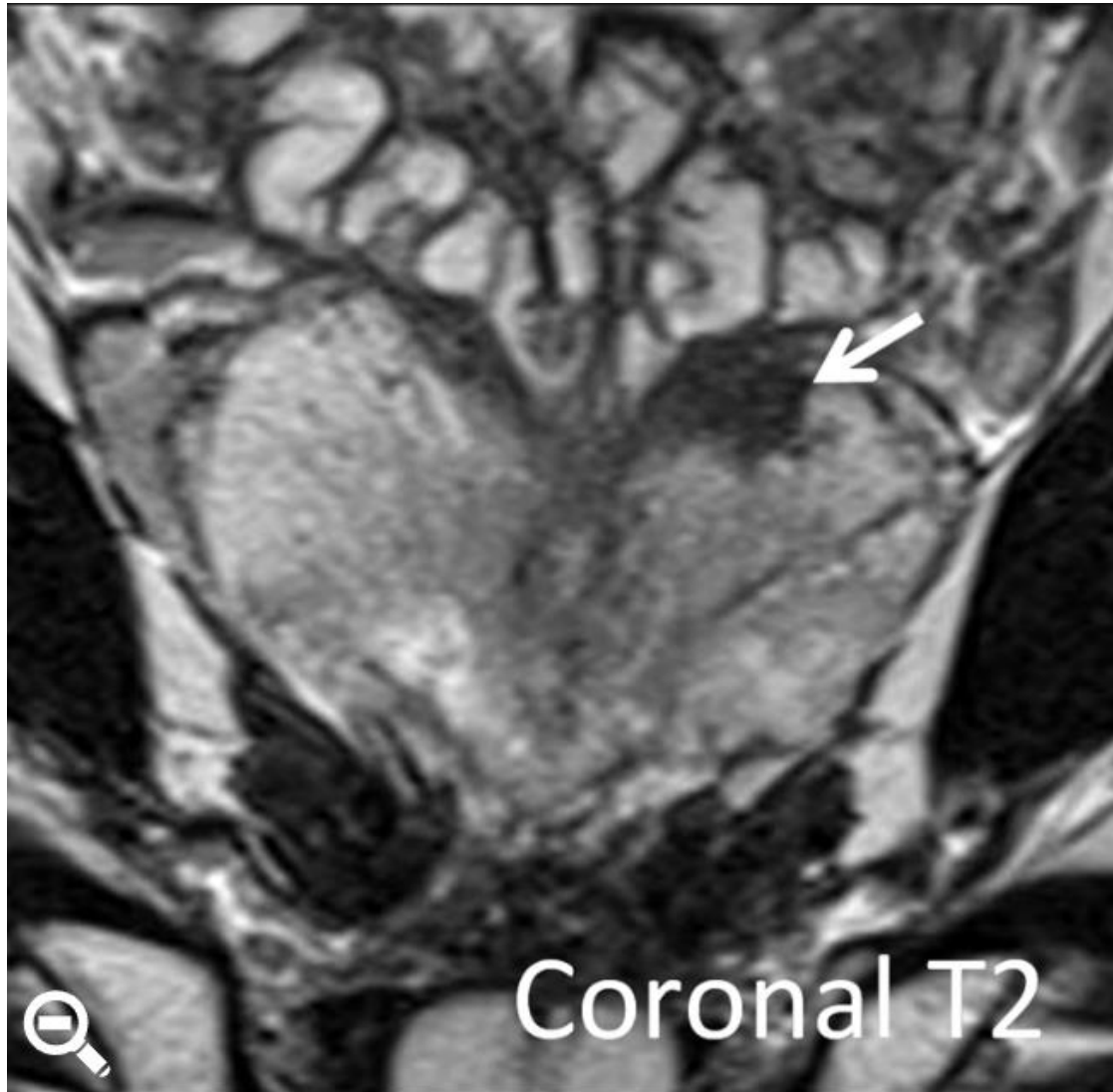


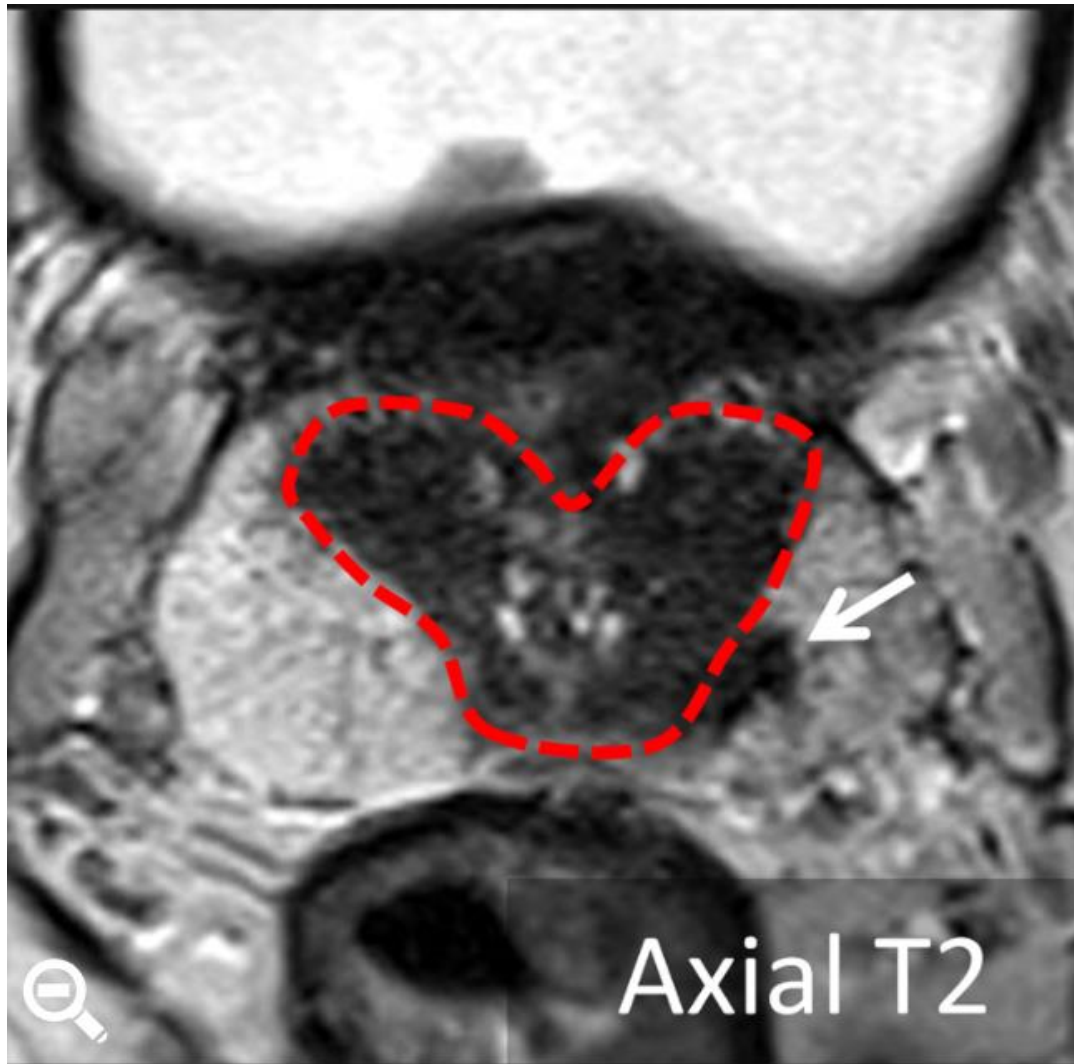


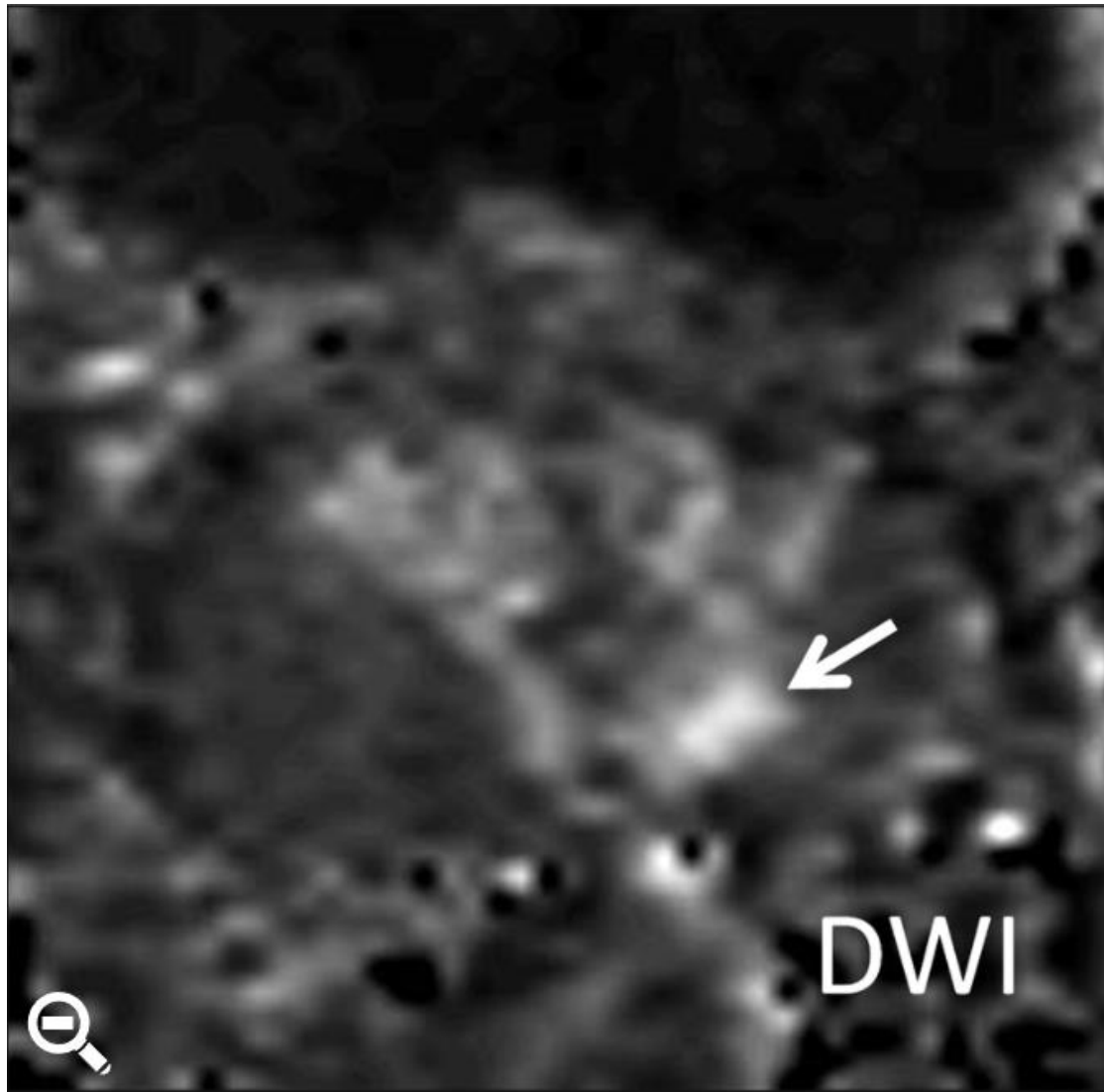
PCa involving the CZ

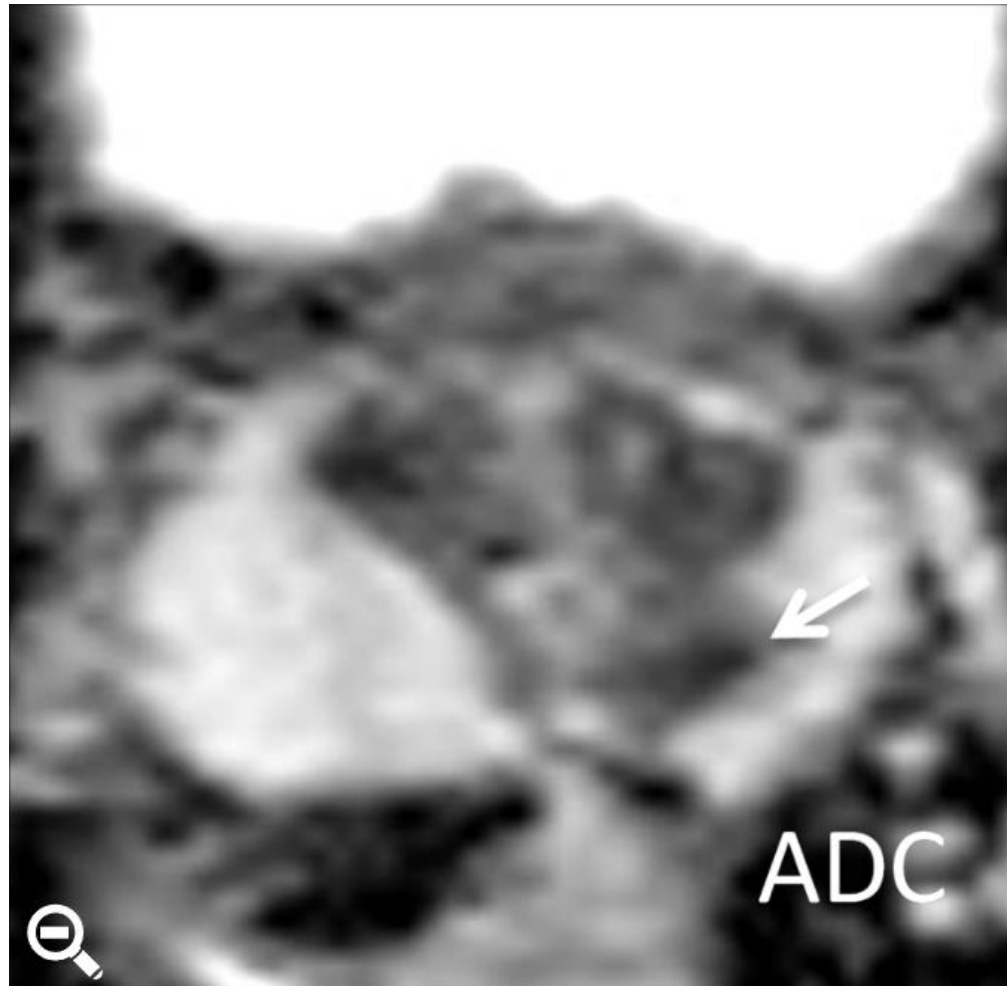
Coronal and axial T2WI show focal asymmetry in the left CZ with low signal intensity similar to the rest of the CZ. The lesion demonstrates high signal intensity on DWI and low signal intensity on ADC map. The lesion demonstrates early arterial enhancement on DCE.

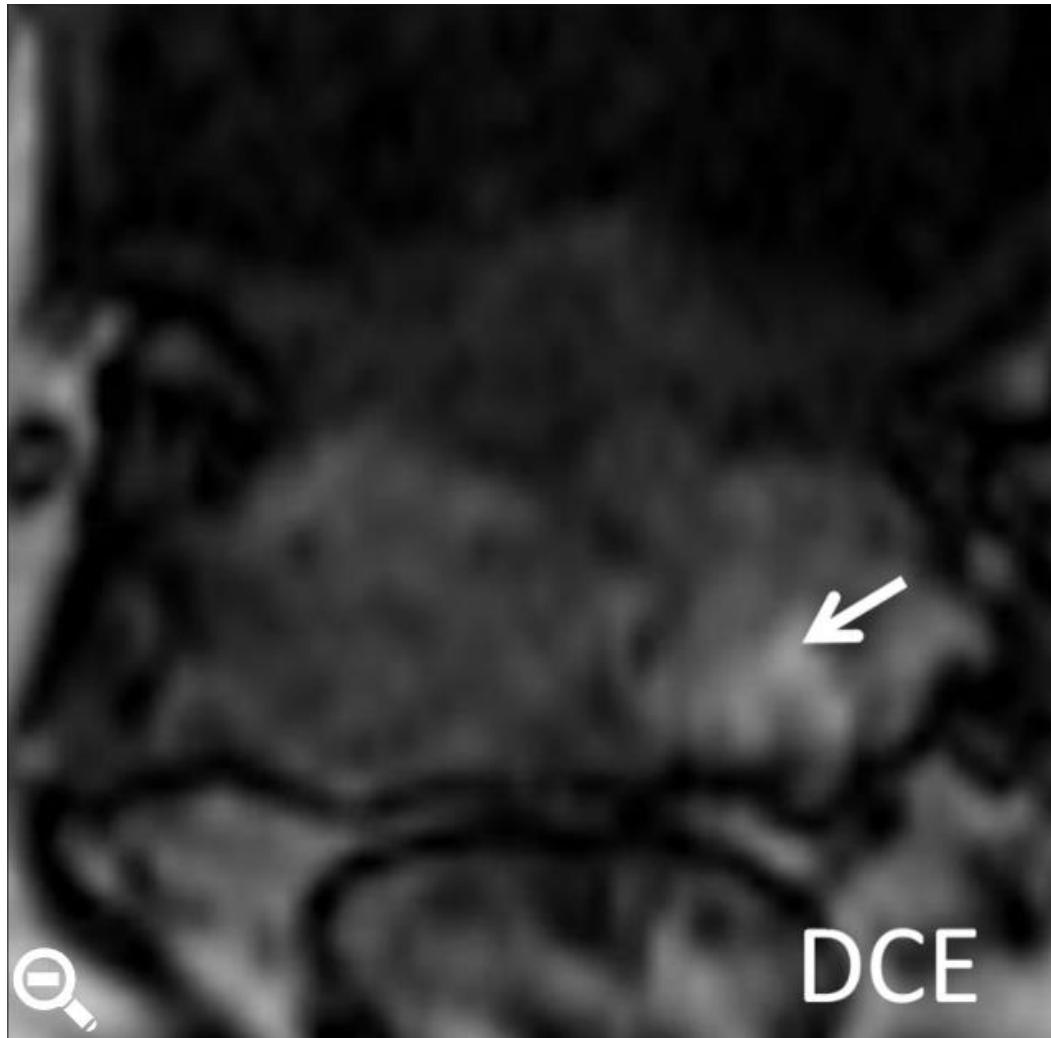






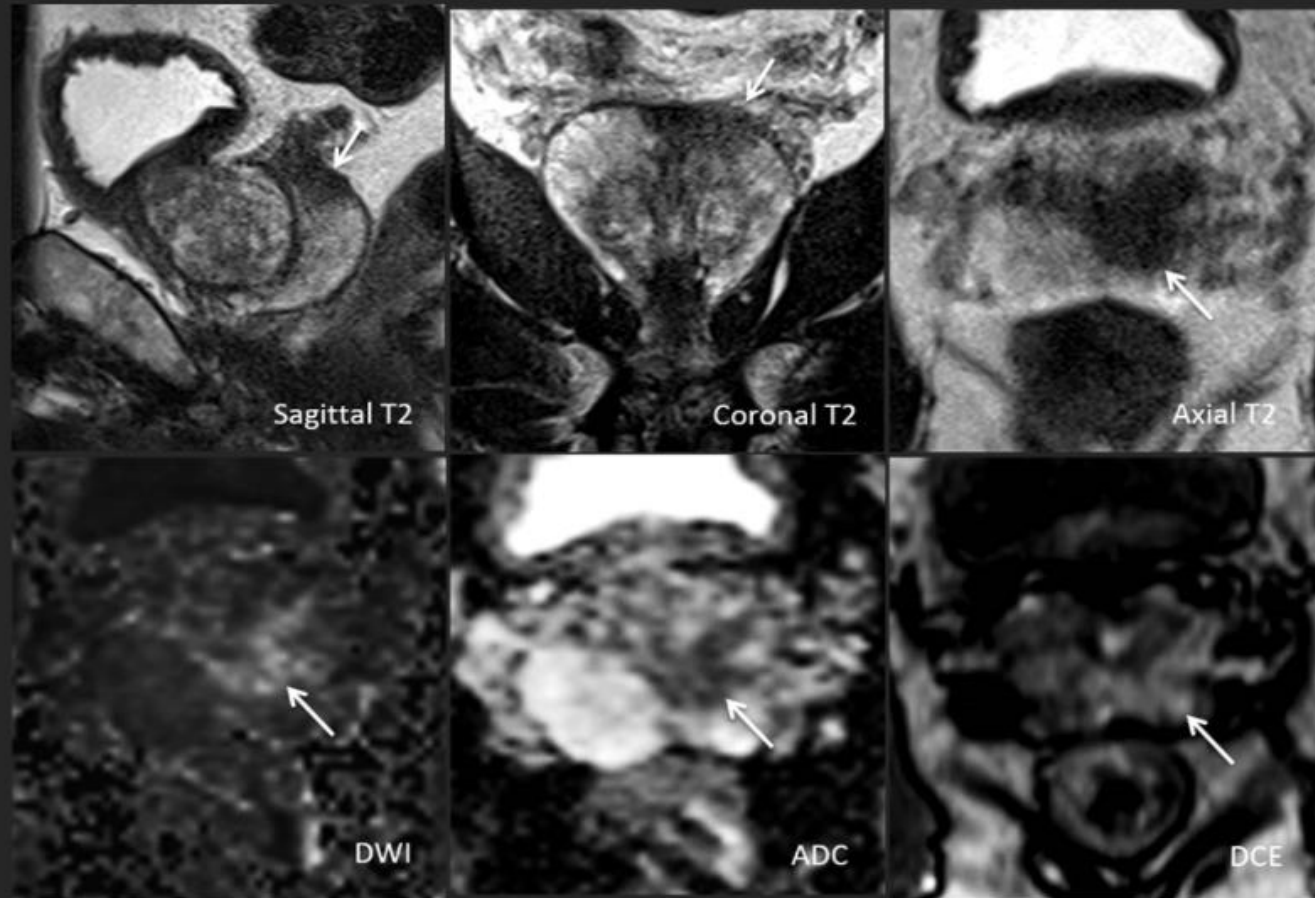






PCa involving the CZ

Sagittal, coronal, and axial T2WI show focal asymmetry in the left CZ with low signal intensity like the rest of the CZ. The lesion demonstrates high signal intensity on DWI, and low signal intensity on ADC map. The lesion demonstrates early arterial enhancement on DCE.



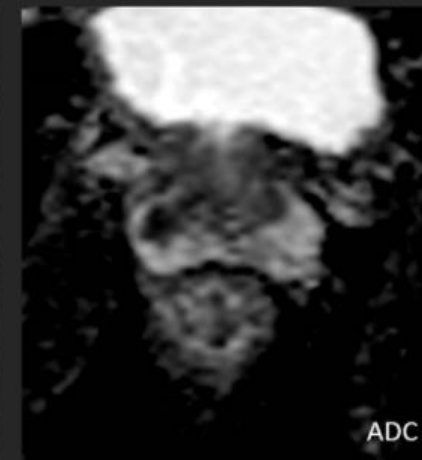
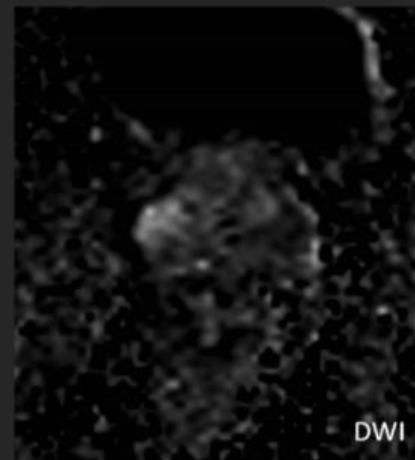
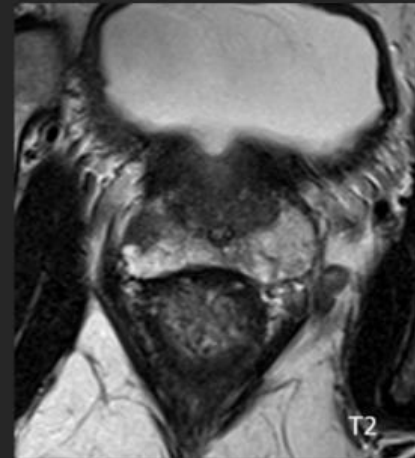
Which of the following is the dominant parameter for scoring abnormalities located in the peripheral zone?

A. T2WI

B. DWI/ADC

C. Dynamic contrast enhanced T1WI

D. MR spectroscopy



Question 1 of 7

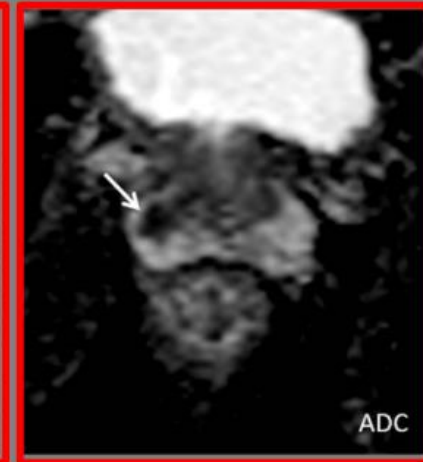
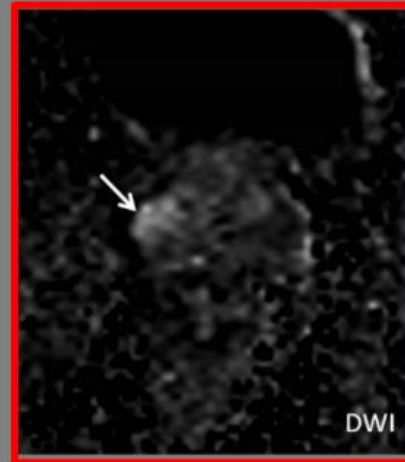
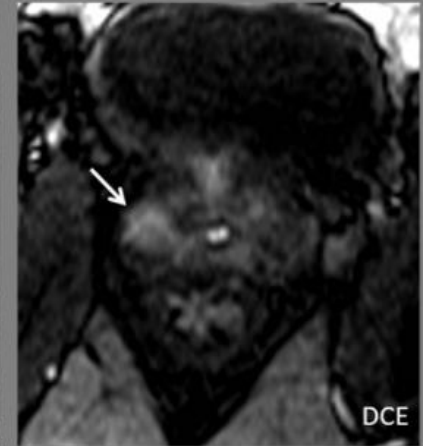
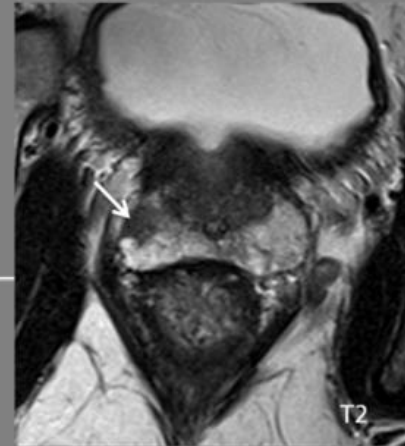
Submit

B. DWI/ADC

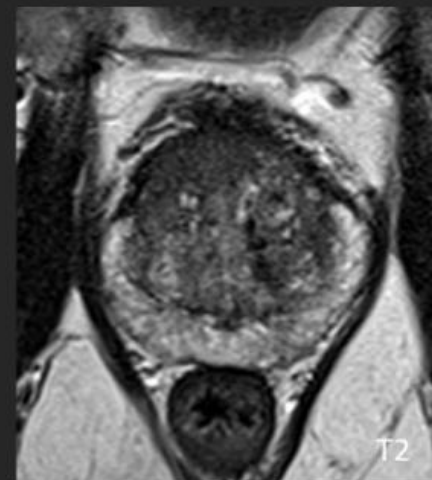
Correct

DWI is the dominant parameter for scoring abnormalities located in the peripheral zone, while dynamic contrast enhanced T1WI plays an ancillary role in the characterization of lesions that receive score 3 on DWI.

Continue



Which of the following is the dominant parameter for scoring abnormalities located in the transition zone?

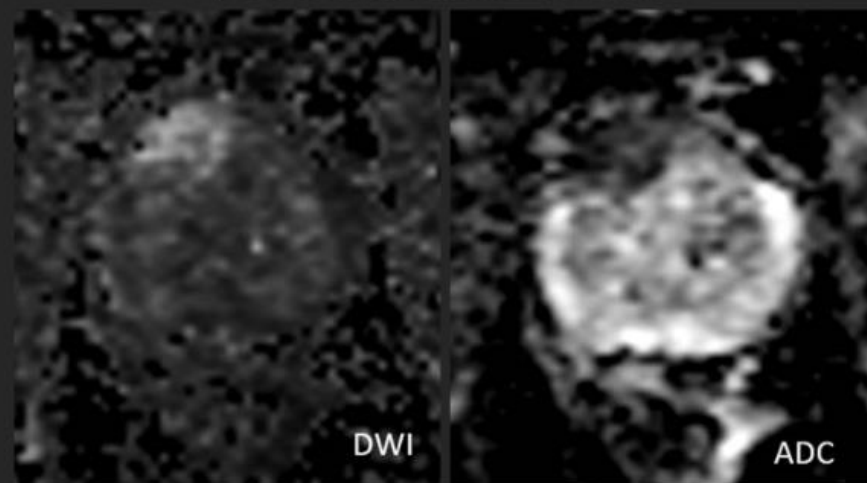


A. T2WI

B. DWI/ADC

C. Dynamic contrast enhanced T1WI

D. MR spectroscopy



Question 2 of 7

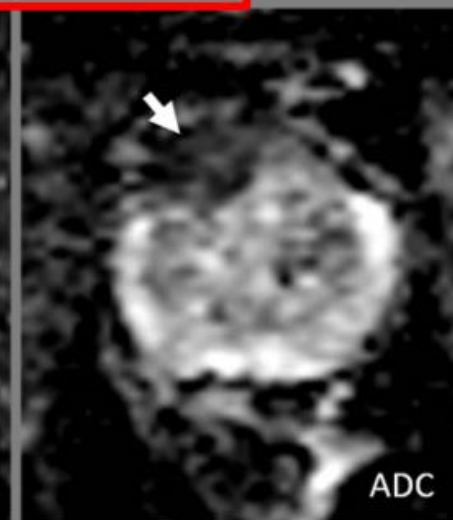
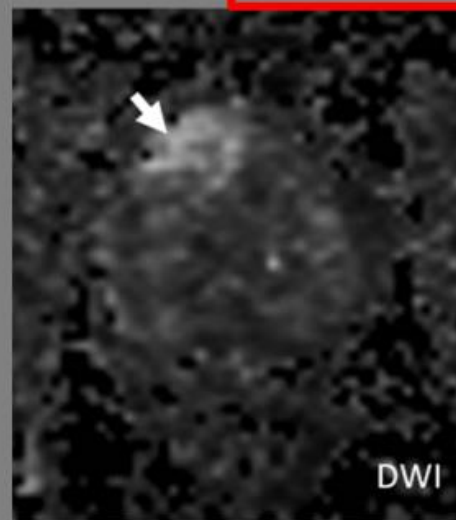
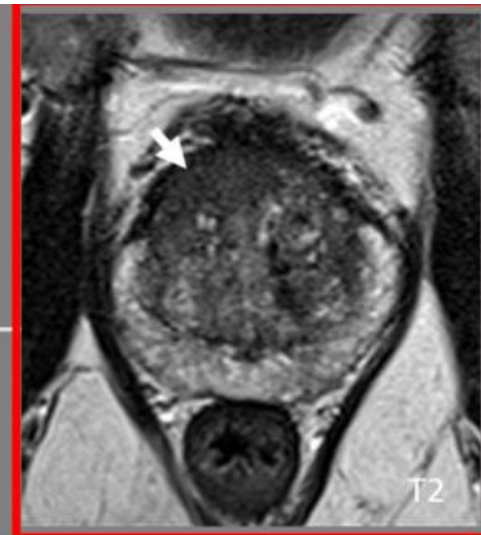
Submit

A. T2WI

Correct

T2WI is the dominant parameter for scoring abnormalities located in the transition zone, while DWI plays an ancillary role in the characterization of lesions that receive scores 2 or 3 on T2WI. Note however, that DWI may be critical to the detection of a nodule as being different from the background of BPH.

Continue



Drag the PI-RADS categories to the corresponding peripheral zone abnormalities displayed in the images on the right:

PI-RADS 1

PI-RADS 2

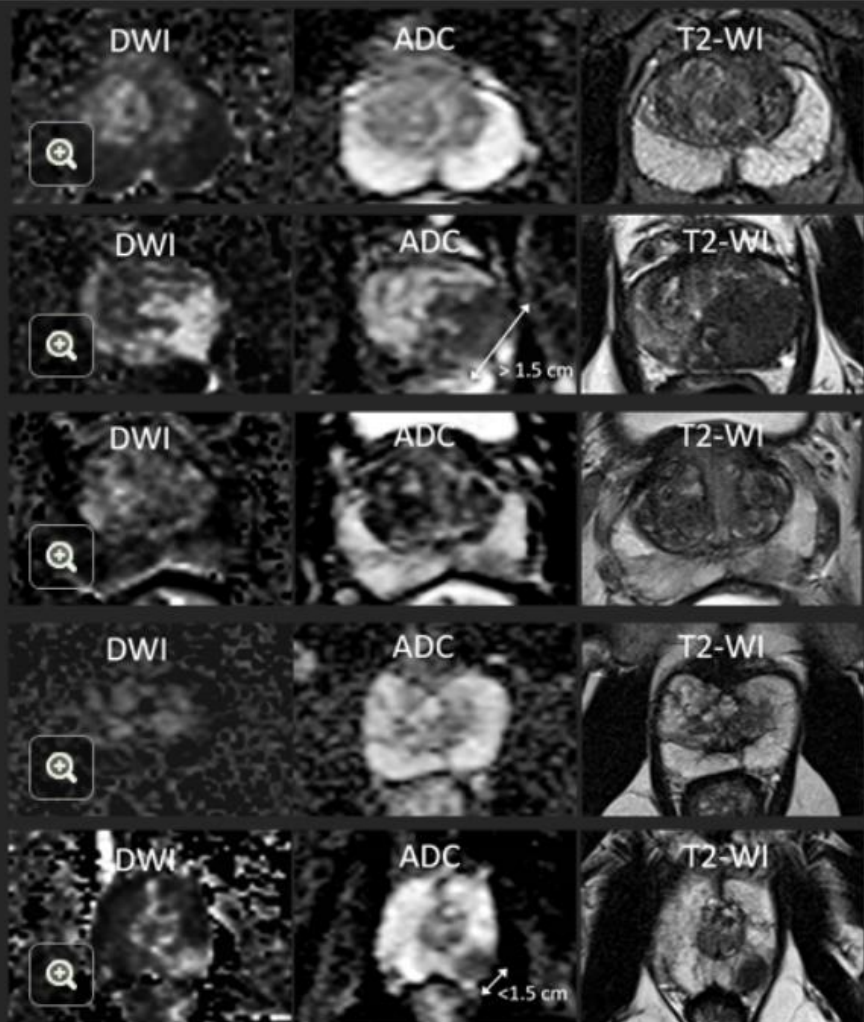
PI-RADS 3

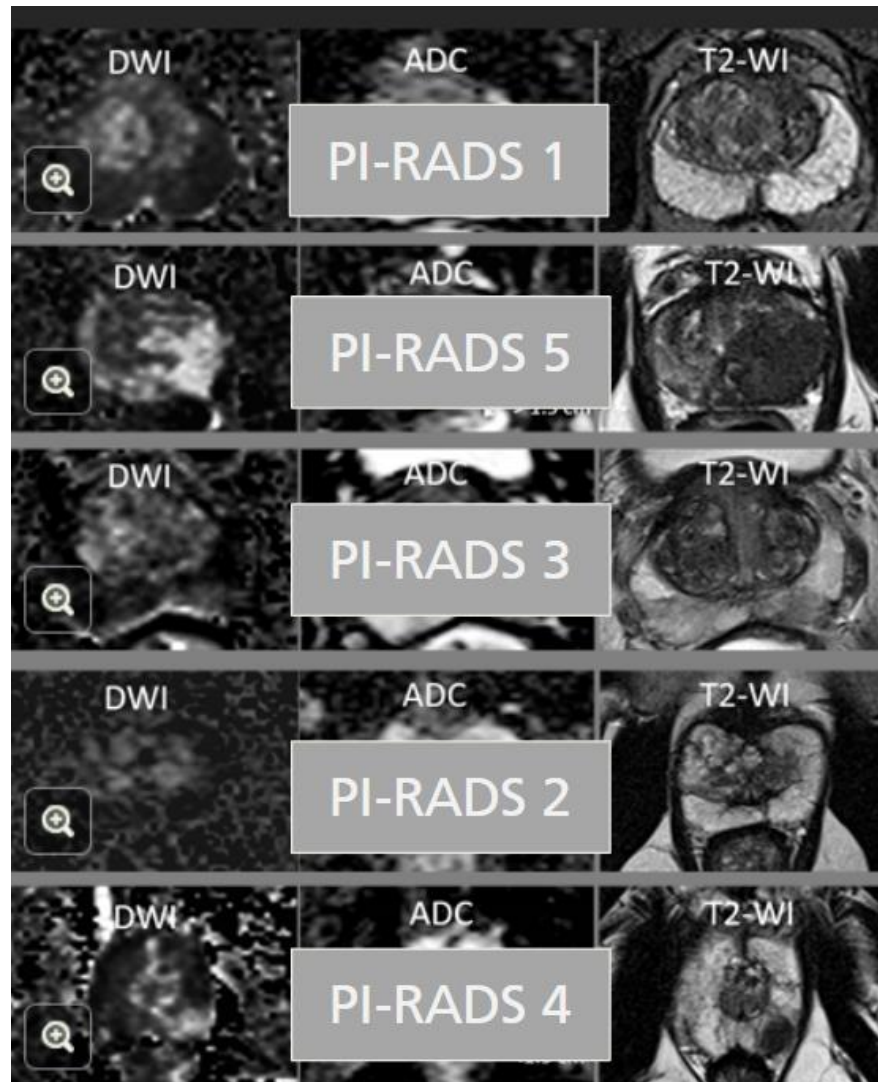
PI-RADS 4

PI-RADS 5

Submit

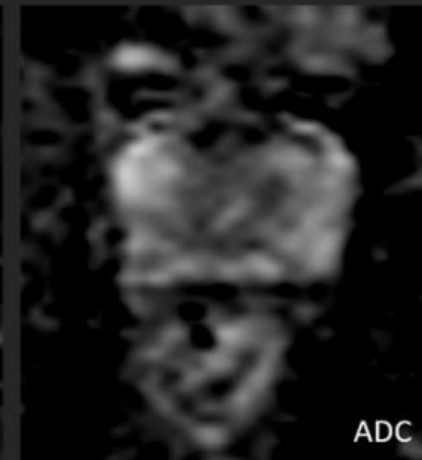
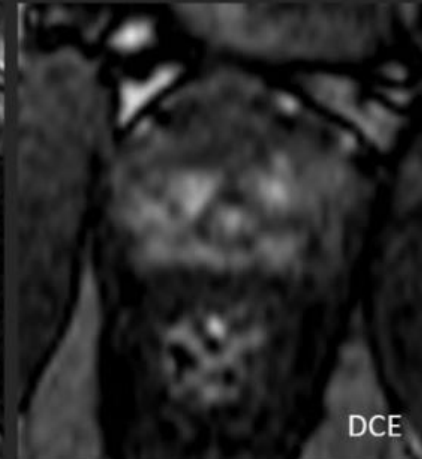
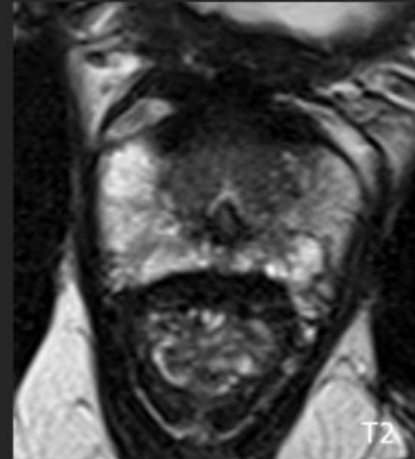
Question 3 of 7





Which of the following features is NOT present in normal anterior fibromuscular stroma?

- A. Low signal on T2WI
- B. Low signal on ADC map
- C. High signal on DWI
- D. Delayed enhancement on DCE



Question 4 of 7

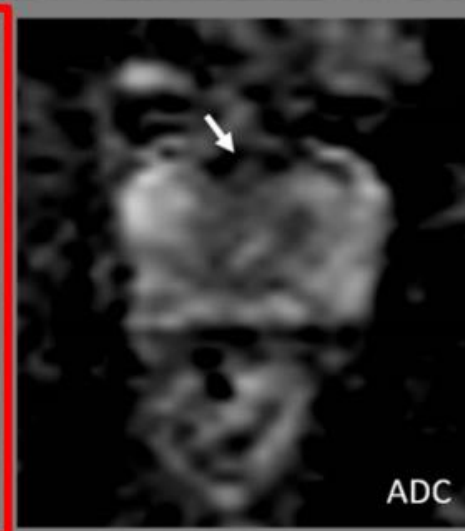
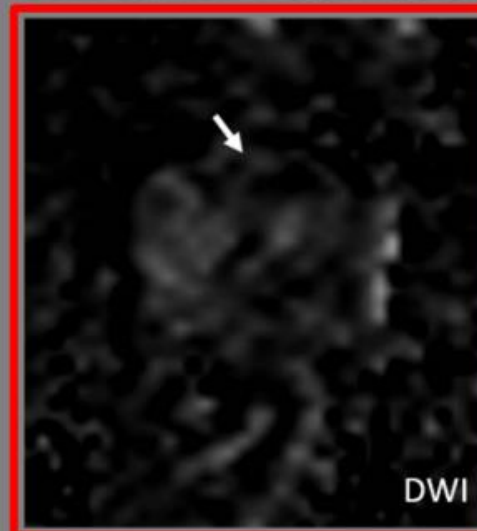
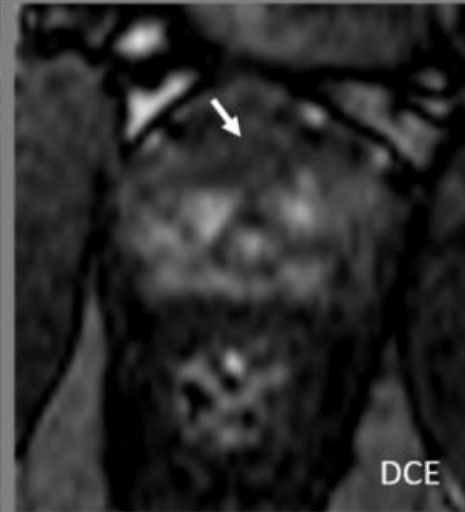
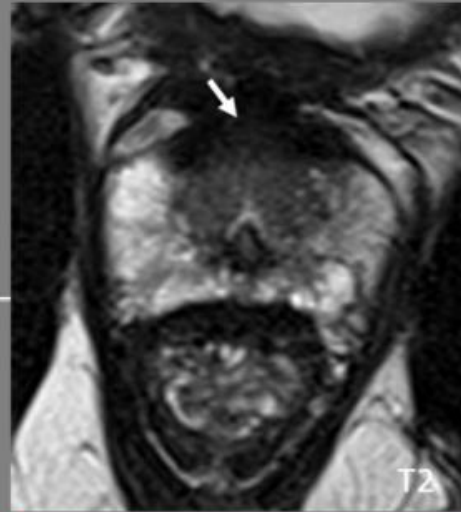
Submit

C. High signal on DWI

Correct

Normal anterior fibromuscular stroma does not display restricted diffusion; hence it should not have high signal on DWI.

Continue



What is the overall PI-RADS assessment category assigned to typical BPH nodules?

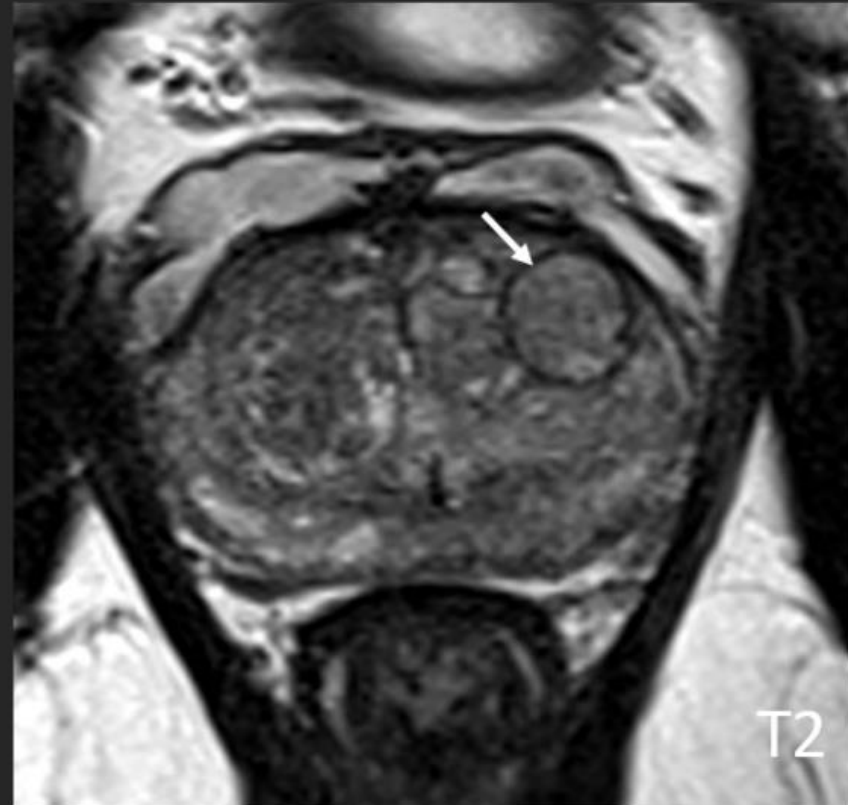
A. PI-RADS 1

B. PI-RADS 2

C. PI-RADS 3

D. PI-RADS 4

E. PI-RADS 5



Question 5 of 7

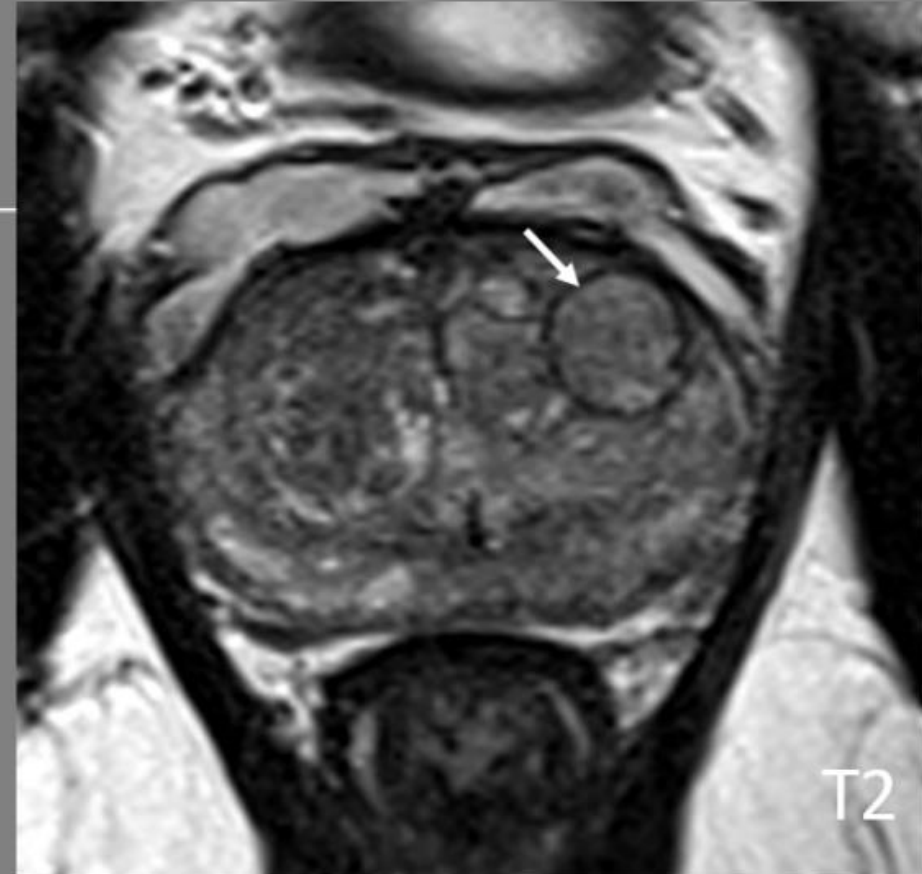
Submit

A. PI-RADS 1

Correct

BPH is a common condition that occurs with aging. The PI-RADS assessment category assigned to typical BPH nodules is 1. Typical BPH nodules do not need to be individually described in the report.

Continue



Which PI-RADS assessment category should be assigned to a 1 cm transition zone abnormality that has a T2WI score 3 AND DWI/ADC score 4?

A. PI-RADS 1

B. PI-RADS 2

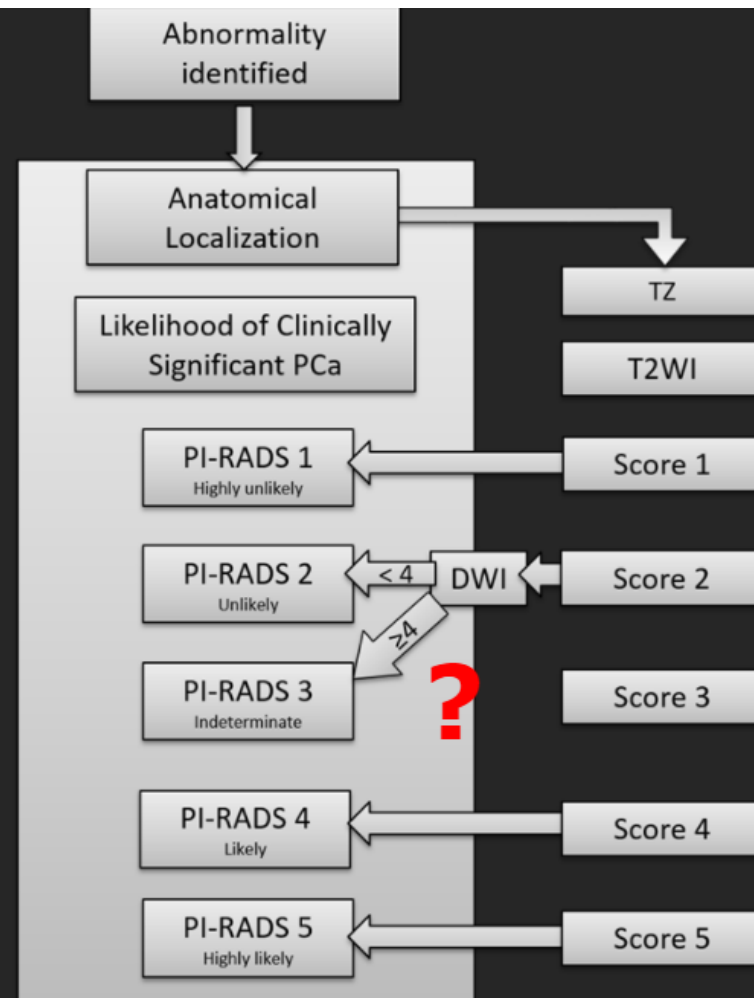
C. PI-RADS 3

D. PI-RADS 4

E. PI-RADS 5

Question 6 of 7

Submit

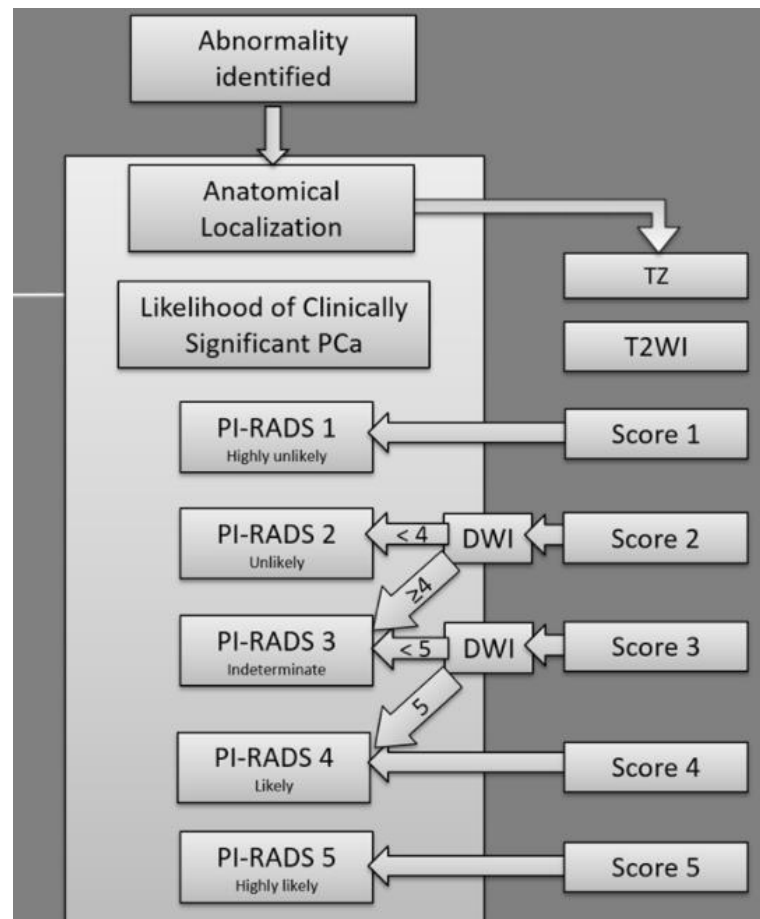


C. PI-RADS 3

Correct

Answer: c. PI-RADS 3

Explanation: Transition zone abnormalities with T2WI score 3 are only upgraded to PI-RADS assessment category 4 if they have a DWI/ADC score of 5.



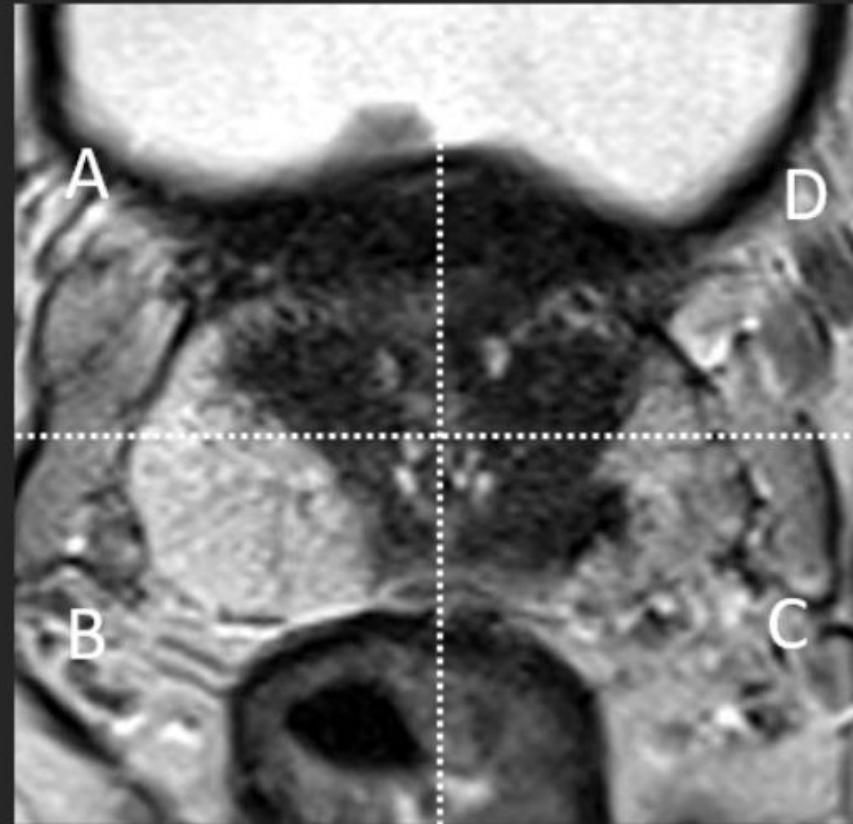
In which quadrant of the axial T2WI is prostate cancer located?

A. A

B. B

C. C

D. D

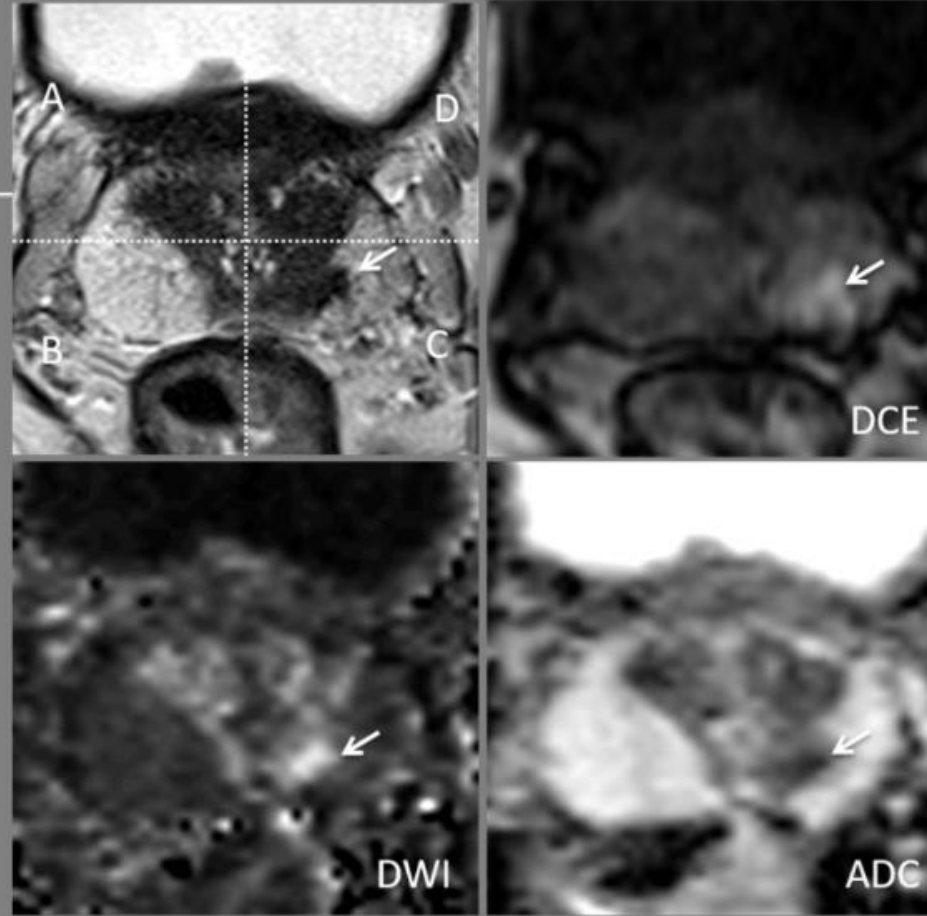


C. C

Correct

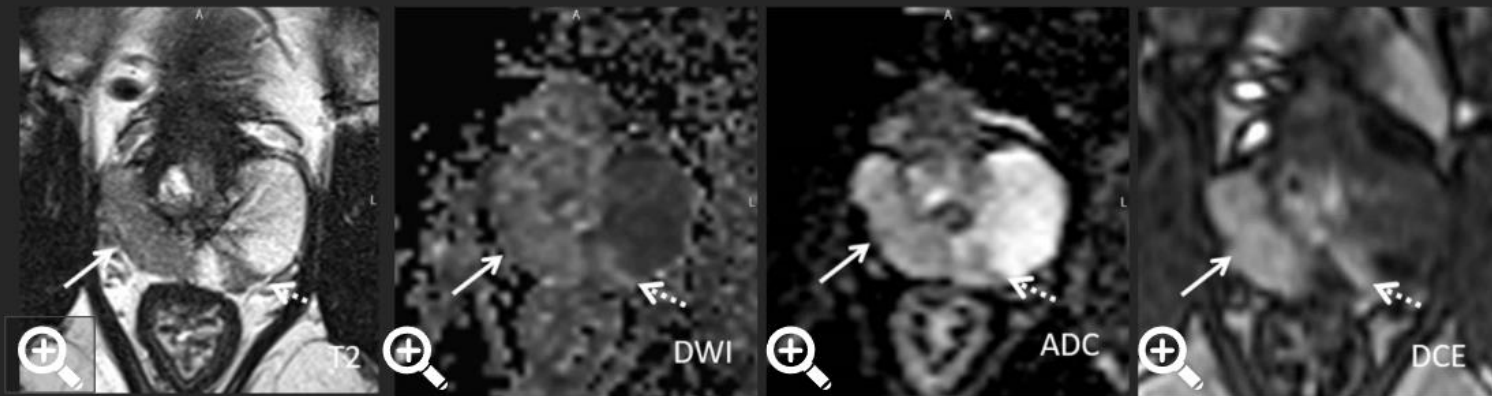
There is a focal low signal asymmetry in the left central zone. In the absence of BPH nodules in the neighboring transition zone causing distortion of the central zone, this finding should raise concern for the presence of cancer. DWI/ADC map and DCE images reveal corresponding signal abnormalities.

Return to Menu



Prostatitis

- Common cause of prostate-specific antigen elevation and lower urinary tract symptoms.
- Can cause signal abnormalities in the PZ and TZ in all pulse sequences.
- The morphology and degree of signal abnormality may be helpful in distinguishing prostatitis from PCa.
- Distribution: Focal or diffuse.
- Morphology: Lobar, wedge-shaped and linear.



Lobar (solid arrow) and wedge-shaped (dotted arrow) focal abnormalities in the PZ.

Case

1

2

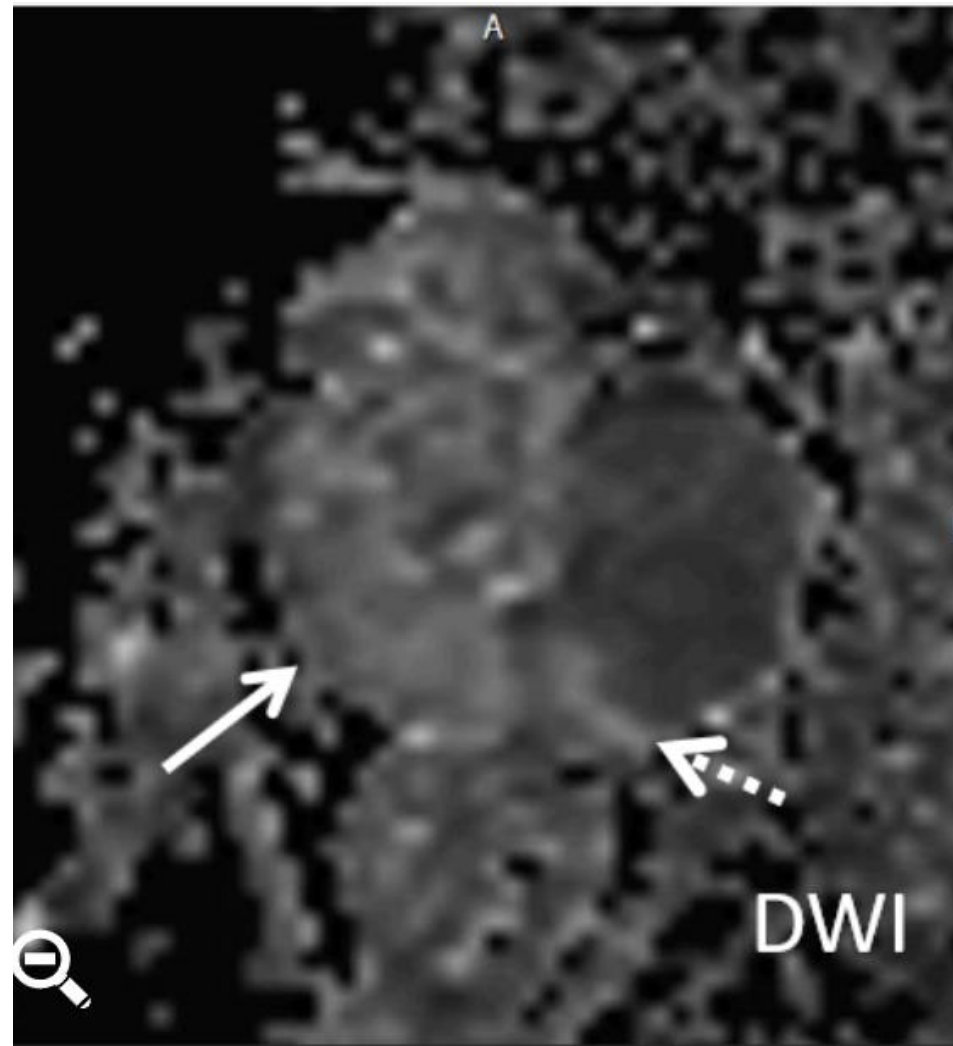
3

Slide 2 of 26

Prostatitis



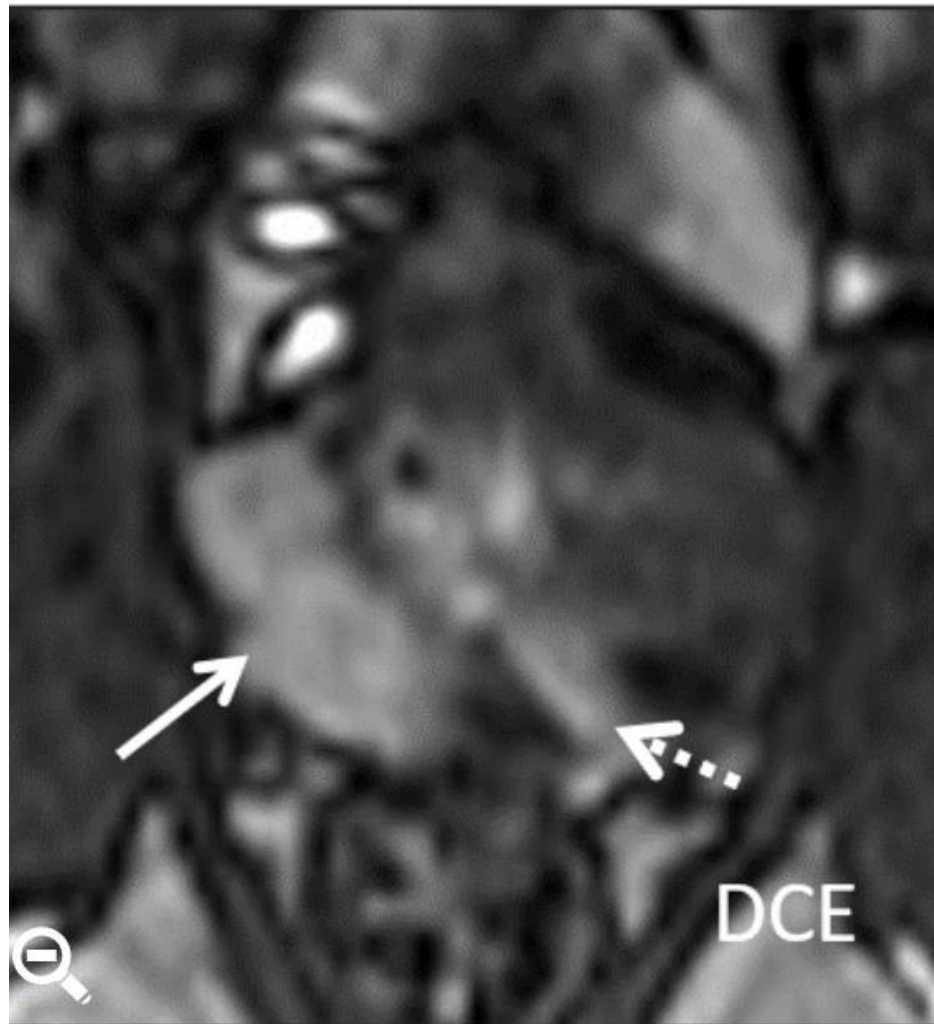
Prostatitis



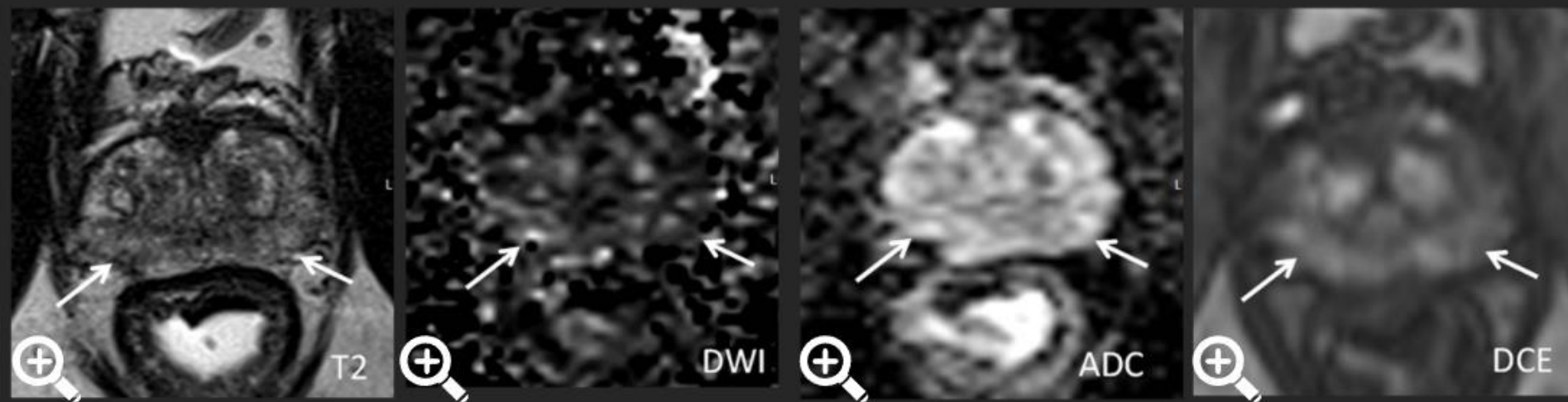
Prostatitis



Prostatitis



Prostatitis



Diffuse signal changes in the PZ (arrows), including mild hypointense signal on T2WI, mild hyperintense signal on DWI, mild hypointense signal on ADC map and early arterial enhancement on DCE images.

Slide 3 of 26

Case

1

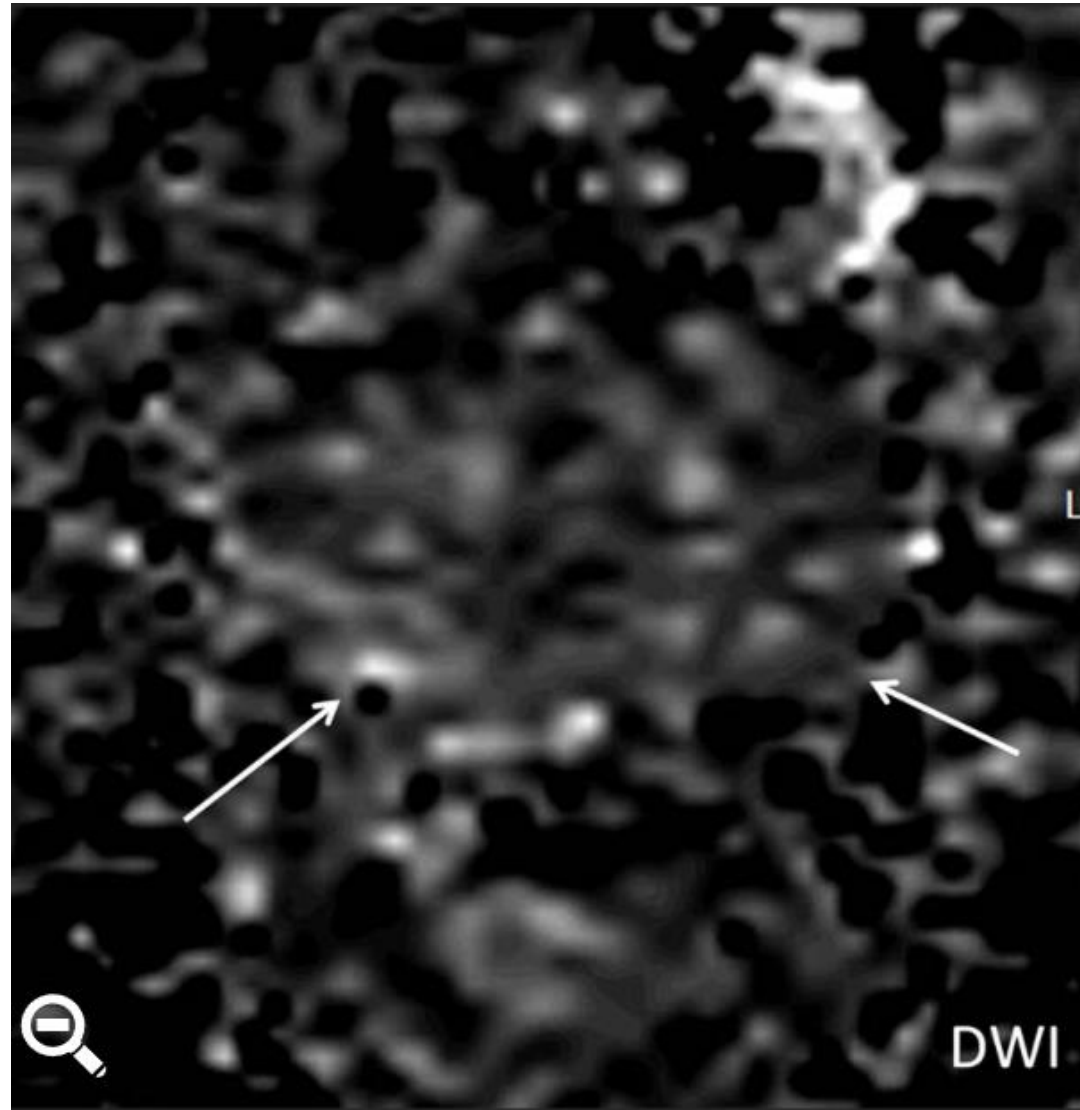
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3

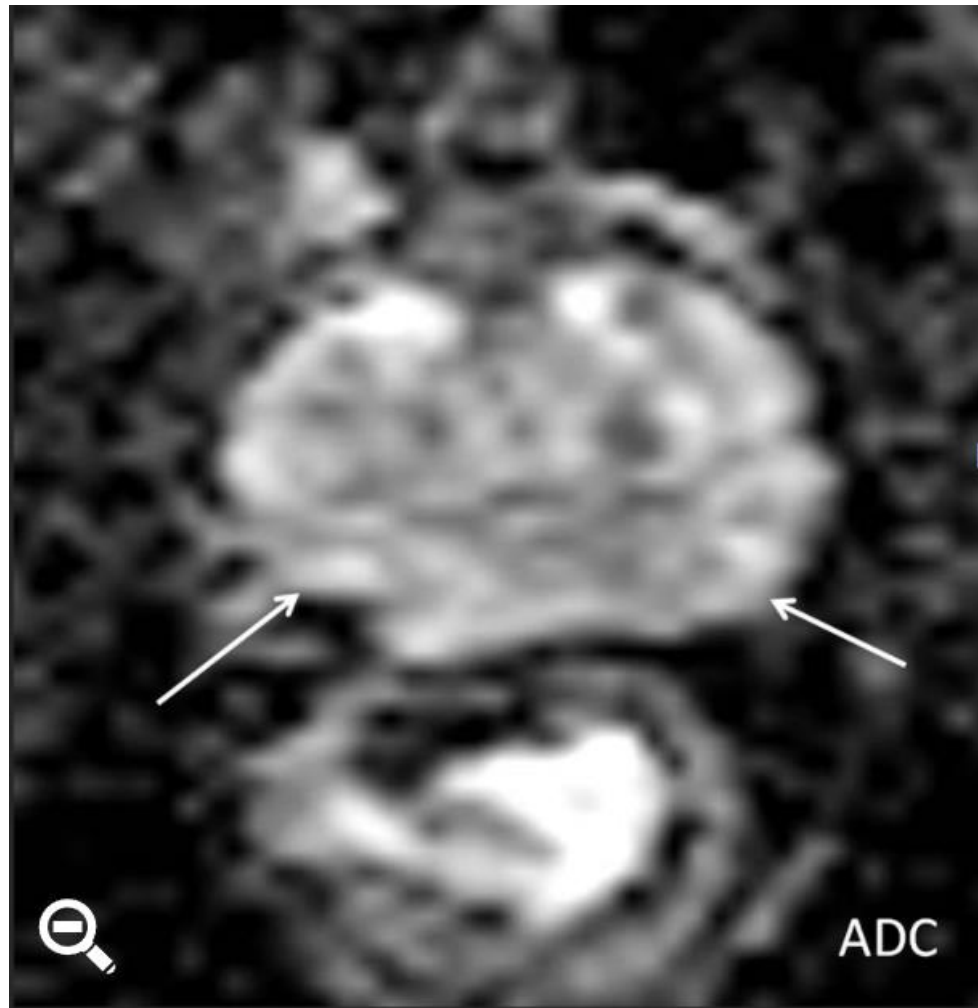
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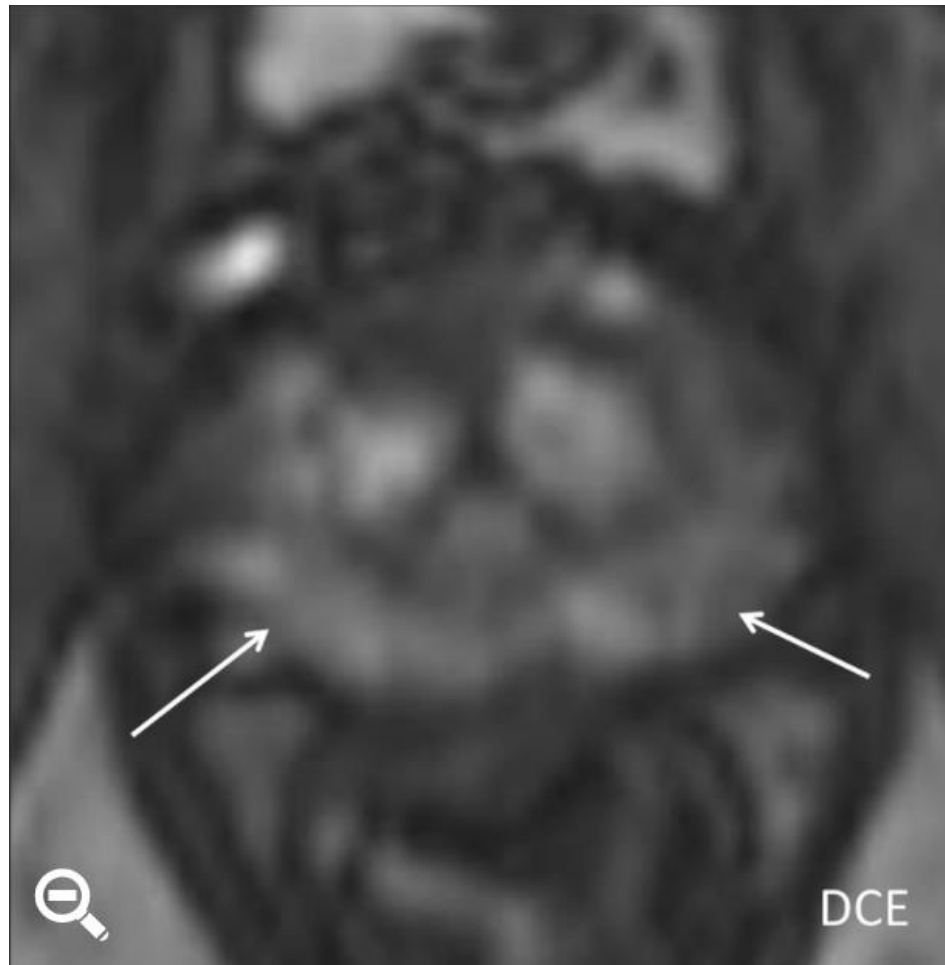
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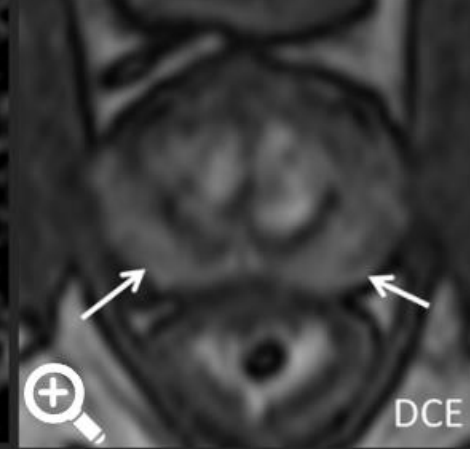
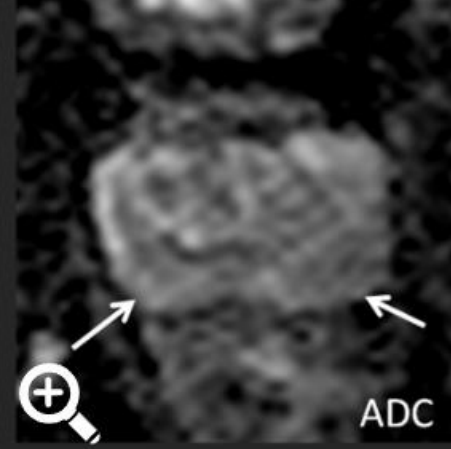
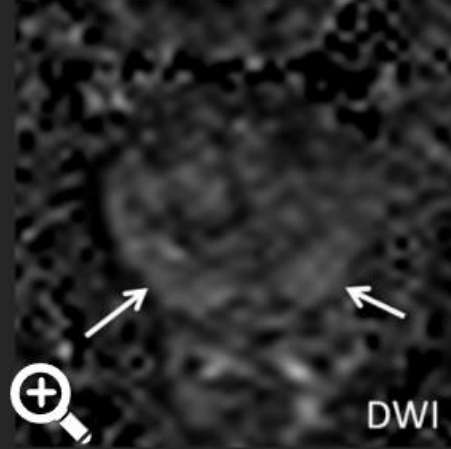
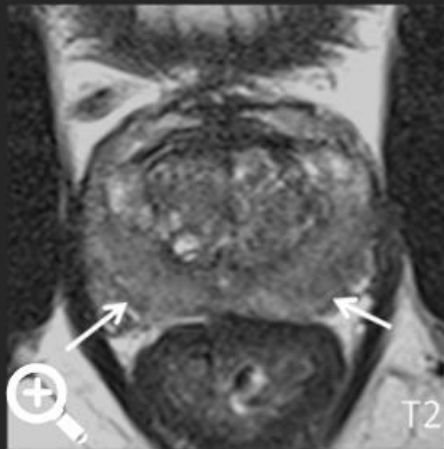
Prostatitis



Prostatitis



Prostatitis

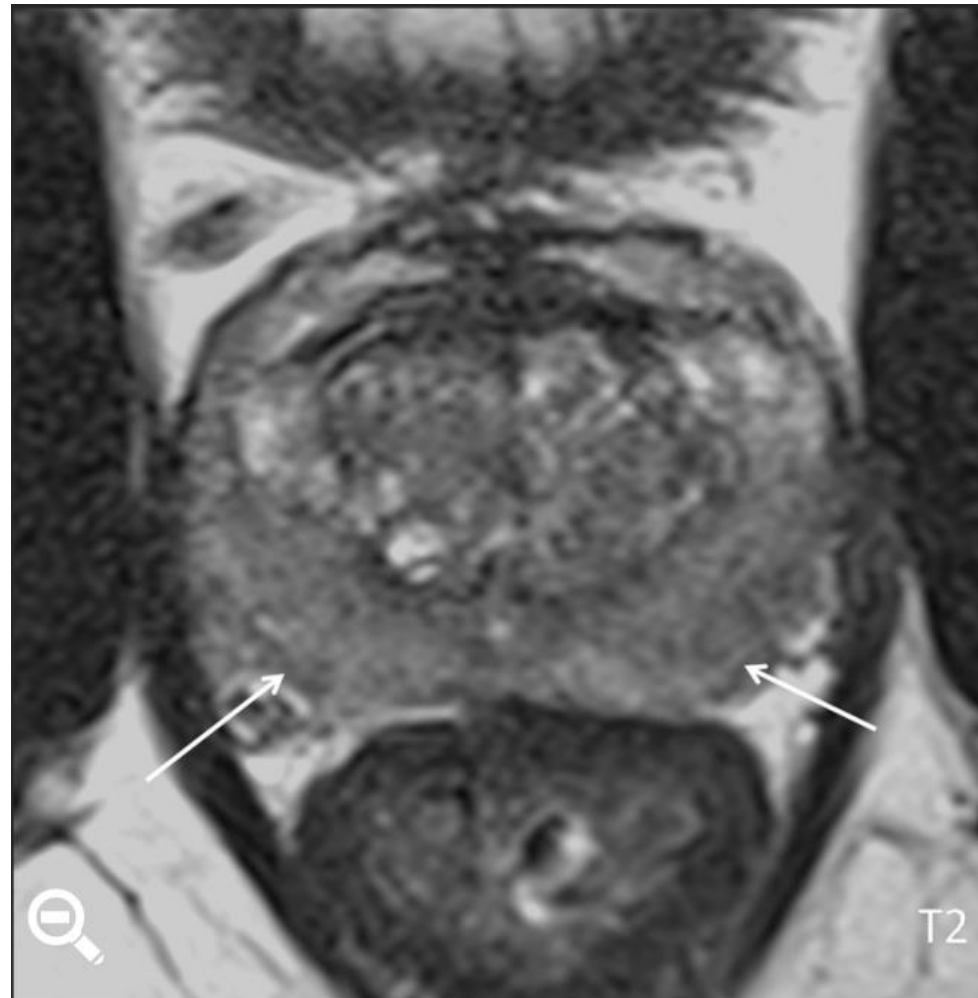


Diffuse signal changes in the PZ (arrows), including hypointense signal on T2WI, mildly hyperintense signal on DWI, mildly hypointense signal on ADC map and early arterial enhancement on DCE images.

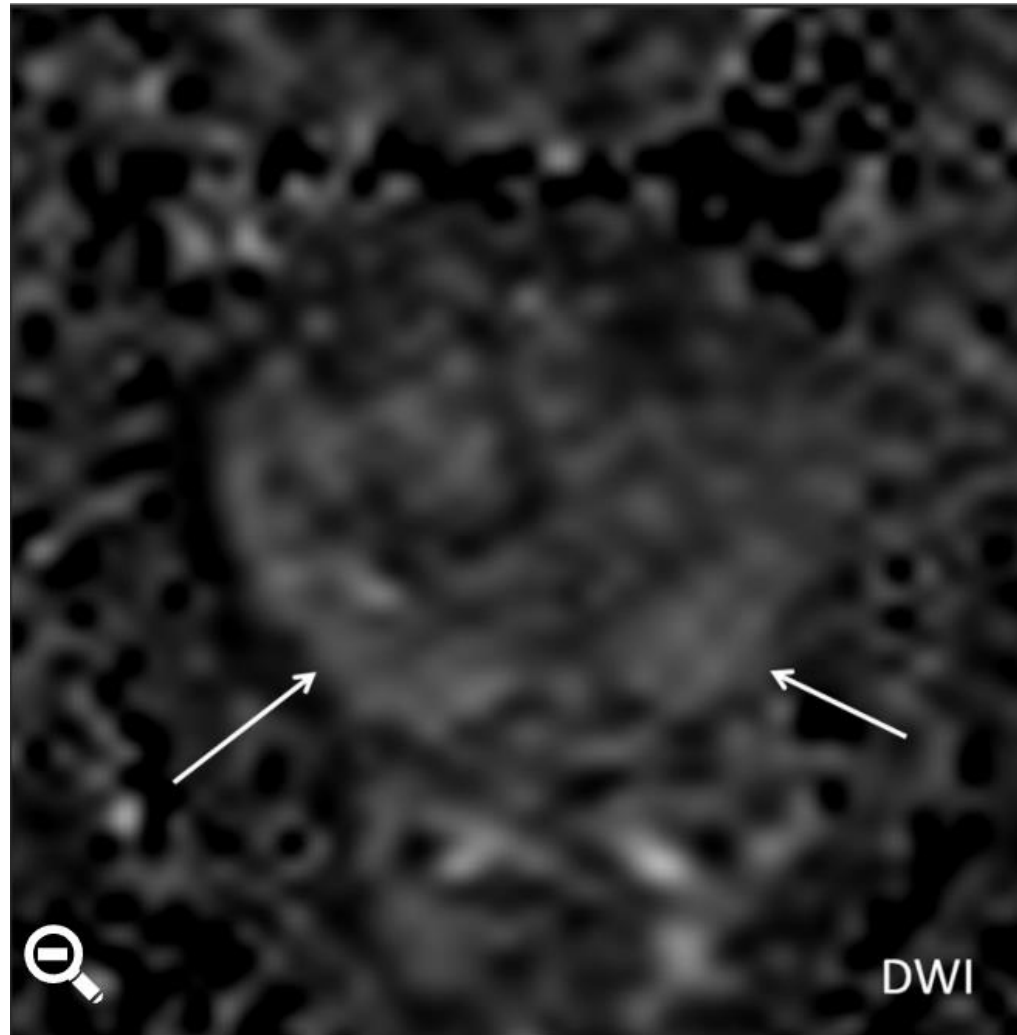
Slide 4 of 26

Case 1 2 3

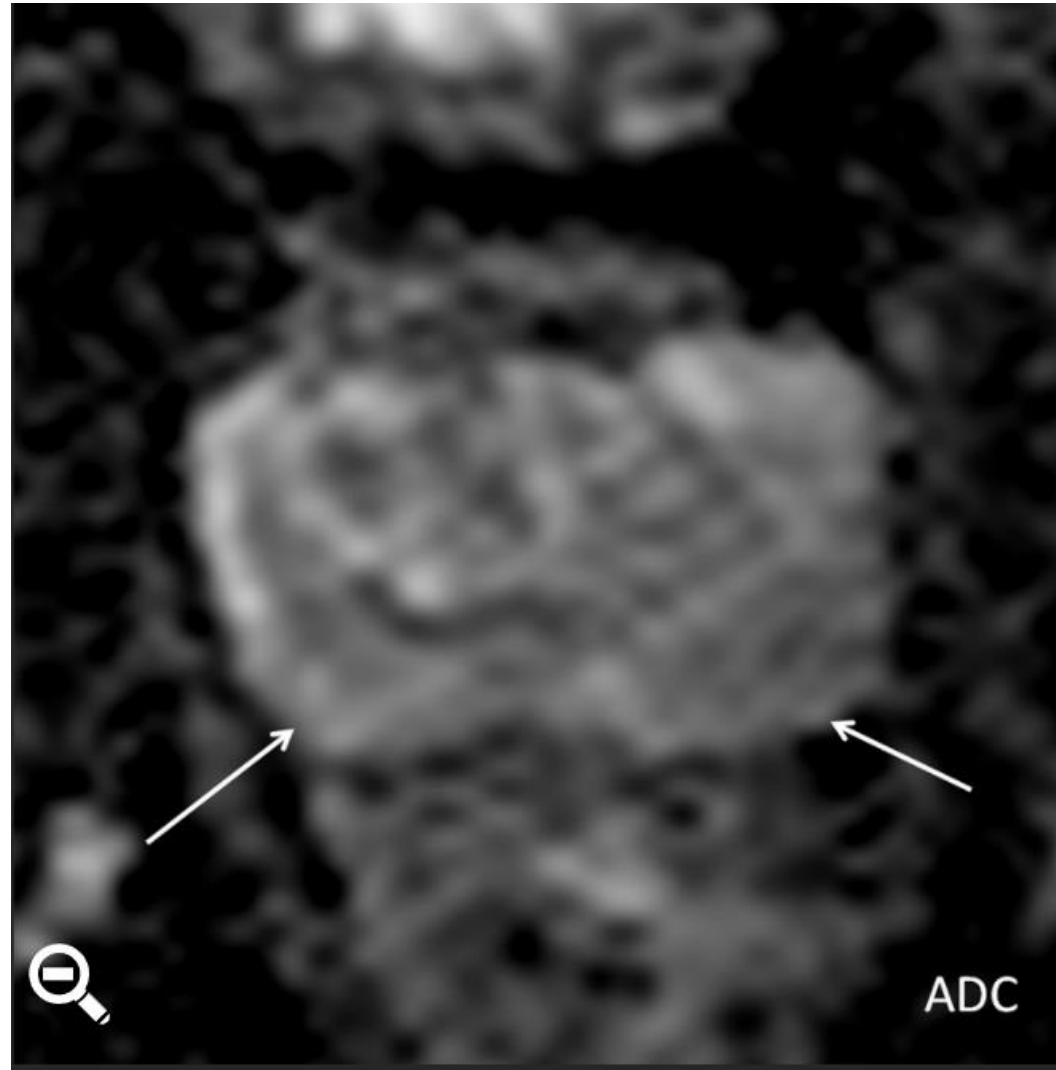
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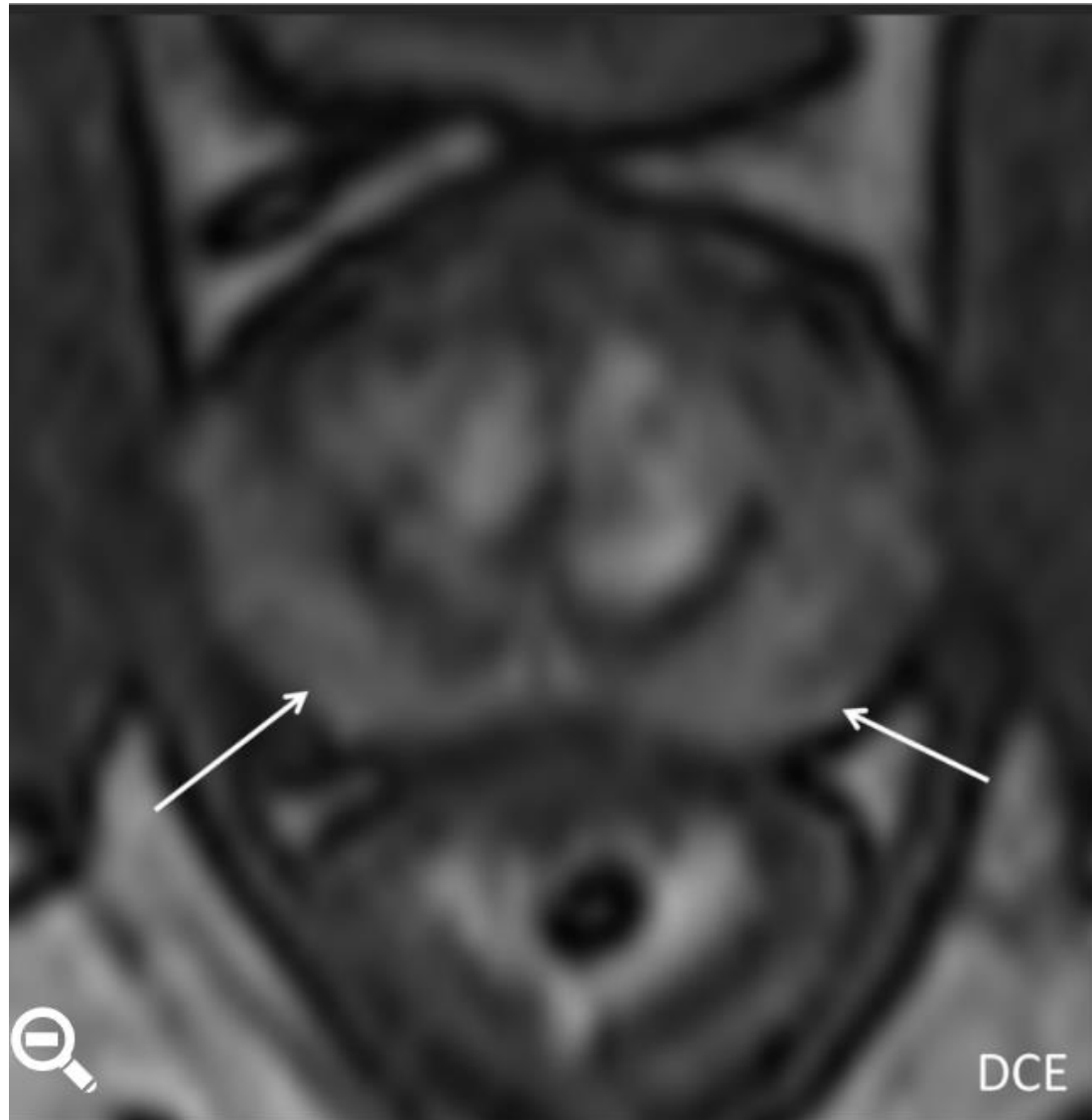
Prostatitis



Prostatitis



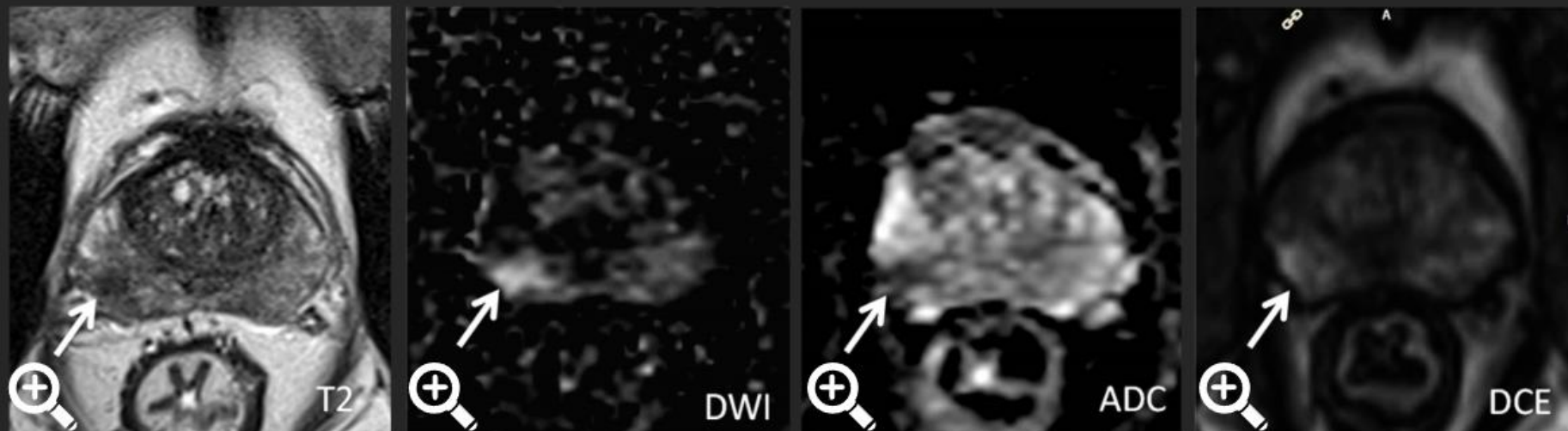
Prostatitis



DA QUI IN POI NIENTE ZOOM IMMAGINI ...

Prostatitis vs. Cancer

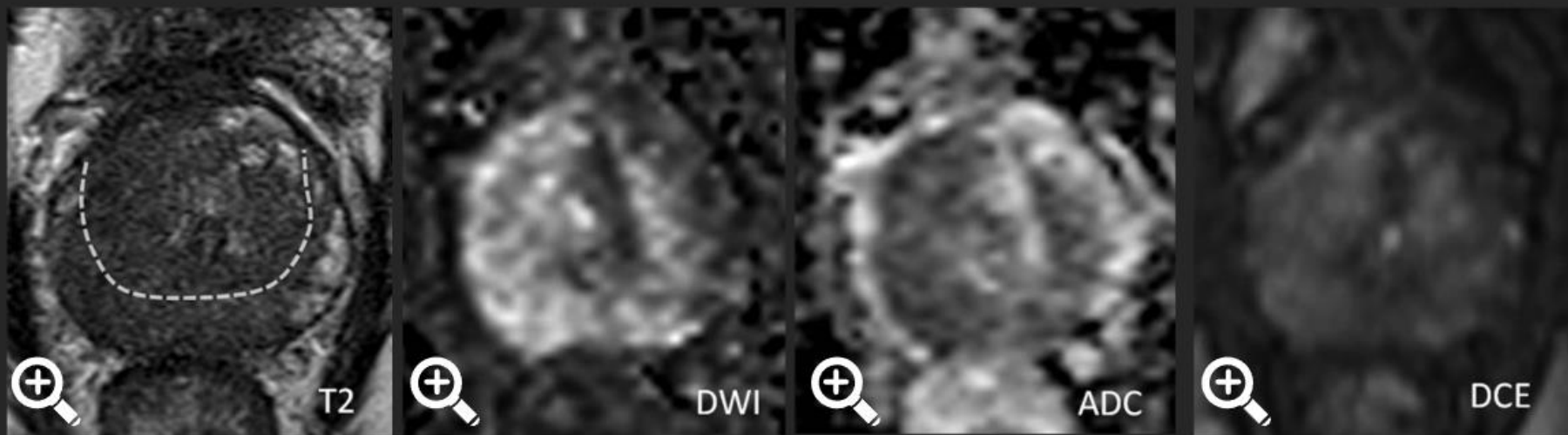
- Diffuse changes from prostatitis can hinder the detection of prostate cancer in the PZ.
- Beware of focal abnormalities that are distinct from the background



In addition to the diffuse signal changes in the PZ related to prostatitis, there is also a PI-RADS assessment category 4 lesion in the right PZ. This lesion differs from the background prostatitis in its DWI and ADC signal characteristics. MRI-guided biopsy of the lesion revealed prostate cancer Gleason score 3 + 4.

Prostatitis vs. Diffuse Cancer

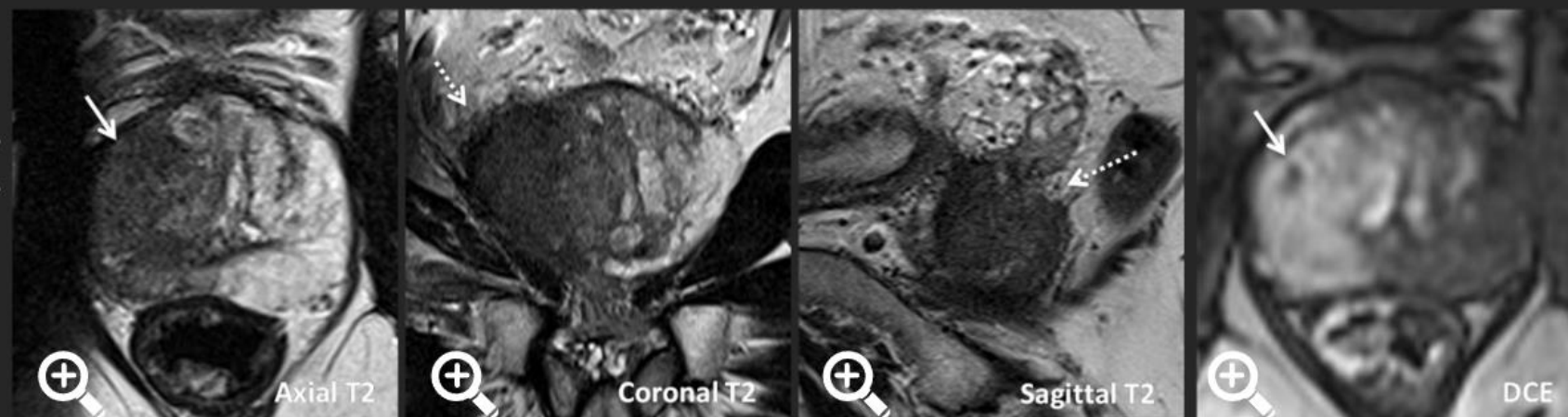
- Diffuse involvement of the prostate by cancer has variable appearance depending on cancer grade.
- Diffuse high-grade cancer tends to have lower signal intensity on T2WI and ADC map and higher signal intensity on DWI compared to prostatitis.
- Obliteration of the surgical capsule with loss of normal zonal anatomy suggest the presence of infiltration by high grade cancer.



Diffuse hypointense signal on T2W with obliteration of the surgical capsule ---> There is hyperintense signal on DWI and hypointense signal on ADC map and early arterial enhancement. Biopsy revealed Gleason score 4 + 5 prostate cancer.

Granulomatous Prostatitis

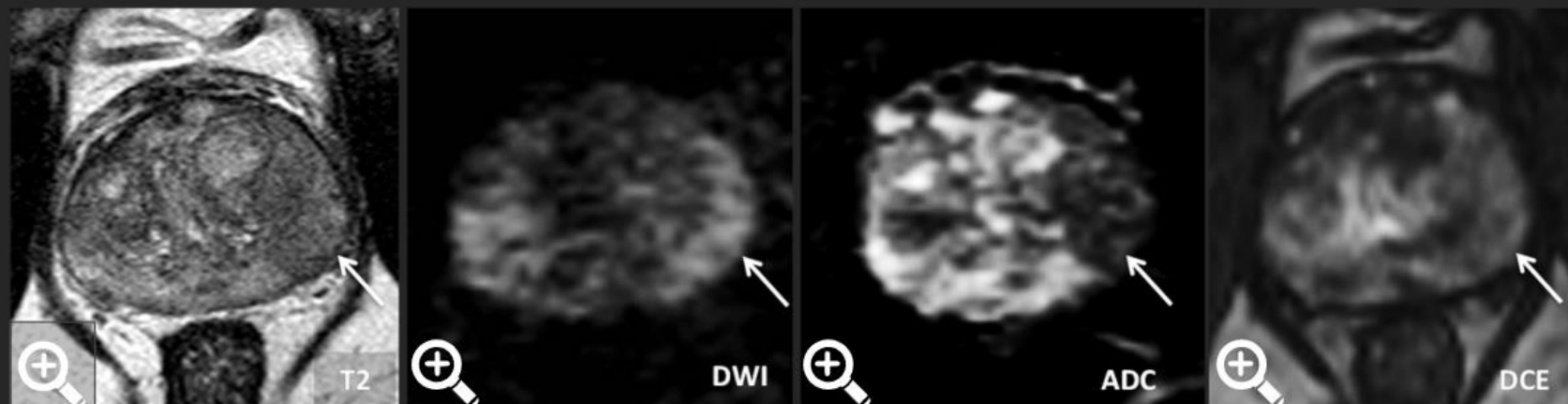
- Etiologies: idiopathic, infectious (e.g. BCG-related in patients treated for bladder cancer) and other granulomatous diseases (e.g. sarcoidosis).
- Can mimic aggressive PCa.
- Abscesses and granulomas can be present.



Right PZ and TZ lesion (arrow) with hypointense signal on T2W and spiculated margins (dotted arrows) suggesting extraprostatic extension. There is early arterial enhancing on DCE. Biopsy revealed granulomatous prostatitis.

Granulomatous Prostatitis

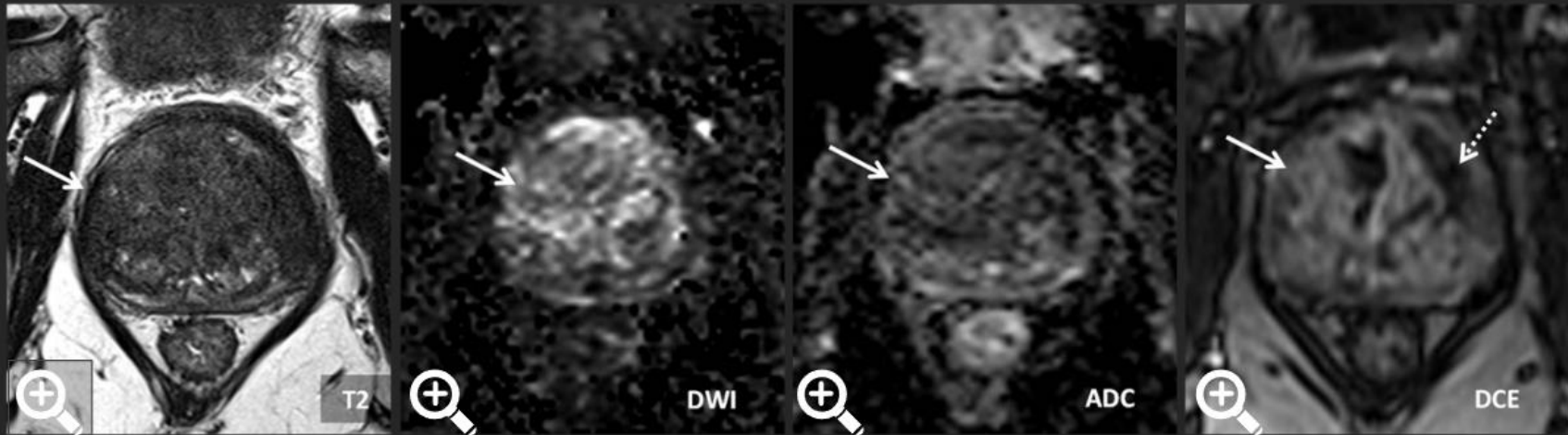
- Etiologies: idiopathic, infectious (e.g. BCG-related in patients treated for bladder cancer) and other granulomatous diseases (e.g. sarcoidosis).
- Can mimic aggressive PCa.
- Abscesses and granulomas can be present.



Patient with history of bladder cancer treated with BCG. There are diffuse signal changes in the prostate with a focal lesion in the left PZ and TZ that demonstrate more intense signal abnormality, especially on the ADC map. Biopsy revealed granulomatous prostatitis.

Granulomatous Prostatitis

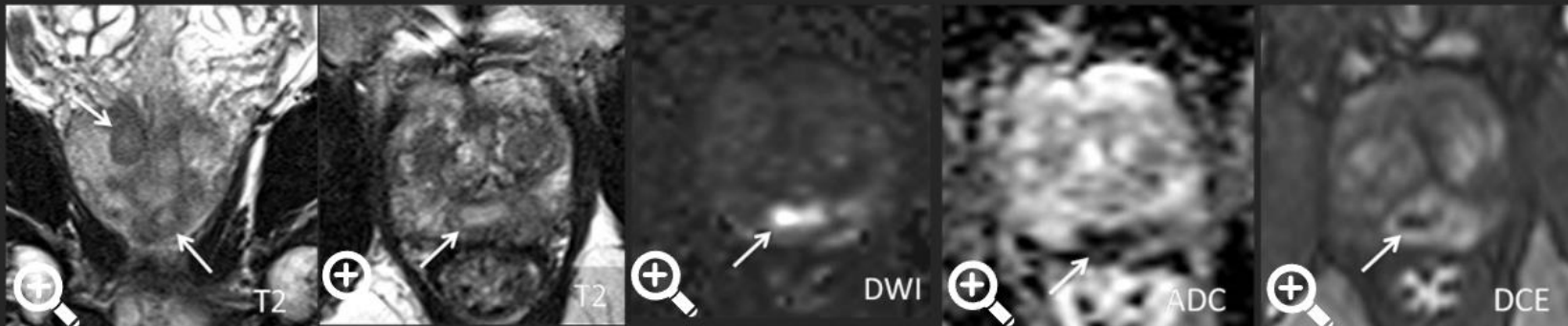
- Etiologies: idiopathic, infectious (e.g. BCG-related in patients treated for bladder cancer) and other granulomatous diseases (e.g. sarcoidosis).
- Can mimic aggressive PCa.
- Abscesses and granulomas can be present.



Diffuse signal changes in the TZ with hypointense signal on T2WI, hyperintense signal on DWI and hypointense signal on ADC map. DCE reveals early arterial enhancement with areas of necrosis----> Biopsy revealed granulomatous inflammation.

Granulomatous Prostatitis

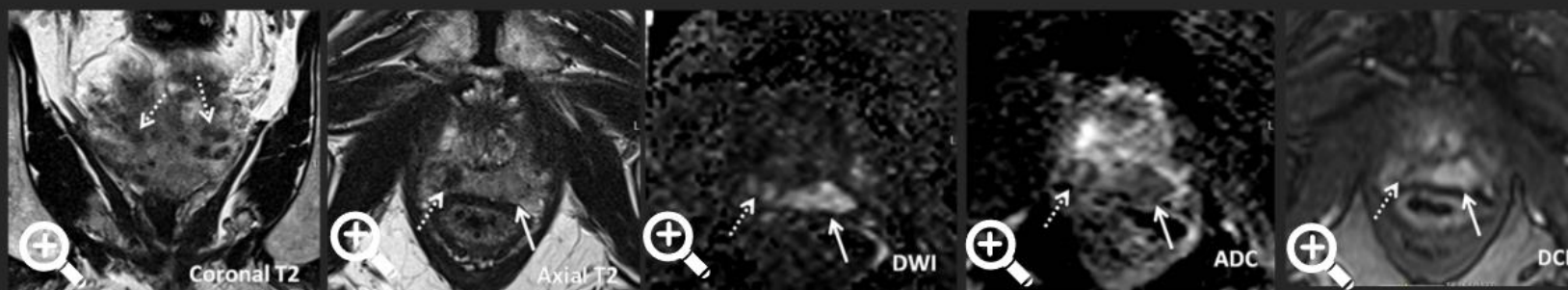
- Etiologies: idiopathic, infectious (e.g. BCG-related in patients treated for bladder cancer) and other granulomatous diseases (e.g. sarcoidosis).
- Can mimic aggressive PCa.
- Abscesses and granulomas can be present.



Abscesses (arrows) in the PZ of patient with bladder cancer treated with BCG. The central portion of the abscess has hyperintense signal on T2WI and DWI, with hypointense signal on ADC map and rim enhancement on DCE.

Granulomatous Prostatitis

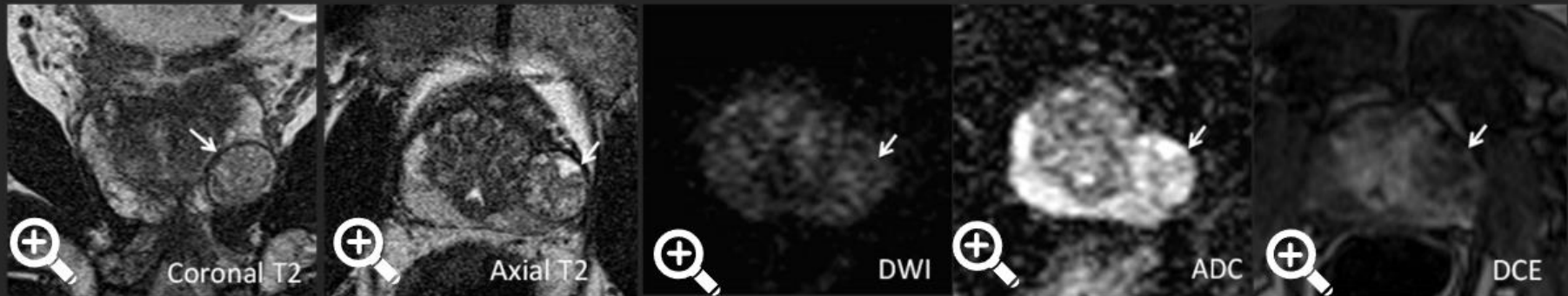
- Etiologies: idiopathic, infectious (e.g. BCG-related in patients treated for bladder cancer) and other granulomatous diseases (e.g. sarcoidosis).
- Can mimic aggressive PCa.
- Abscesses and granulomas can be present.



Multiple granulomas (dotted arrows) in a patient with bladder cancer treated with BCG. The granulomas have hypointense signal on T2WI, hypointense signal on DWI and ADC map and no enhancement on DCE. Focal lesion in the PZ (solid arrow) demonstrates hypointense signal on T2WI, hyperintense signal on DWI, hypointense signal on ADC map and early enhancement on DCE. Biopsy revealed granulomatous prostatitis and no cancer.

Ectopic BPH

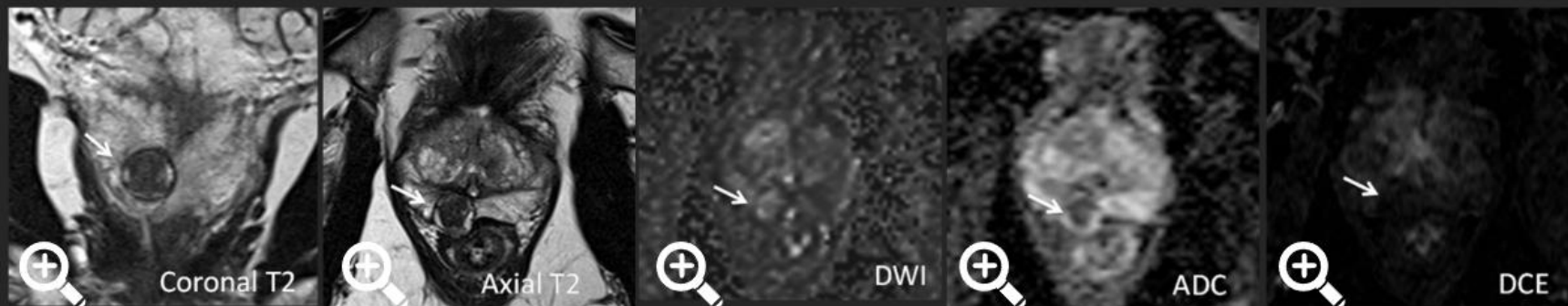
- BPH nodules can be located in the PZ, often abutting the interface between PZ and TZ (i.e. surgical capsule).
- A complete capsule is their main feature, similar to typical BPH nodules in the TZ.
- Multiplanar T2WI can help identify the capsule.
- These nodules are scored as PI-RADS assessment category 2.



Ectopic BPH nodule (arrow) in the left PZ

Ectopic BPH

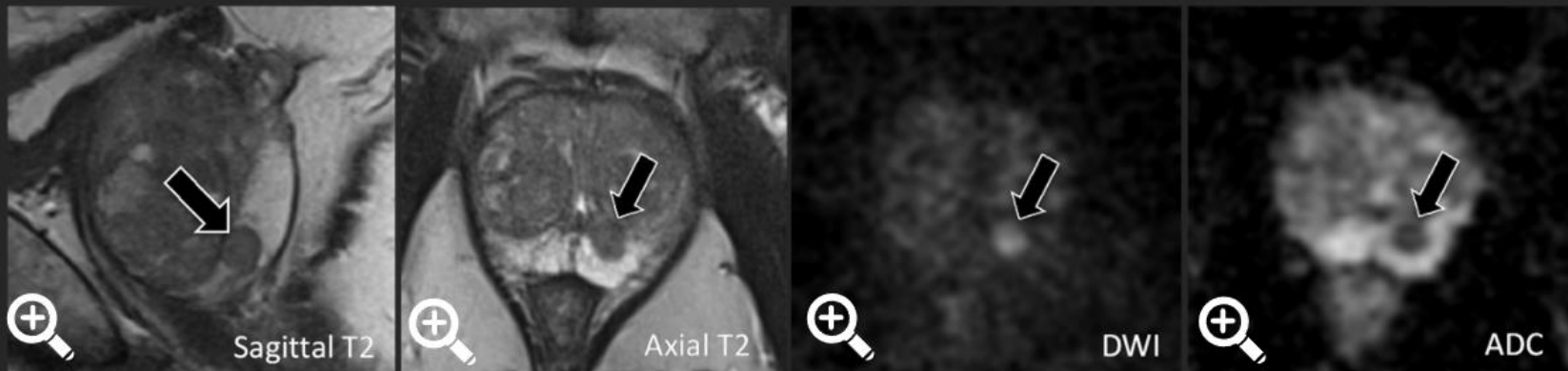
- BPH nodules can be located in the PZ, often abutting the interface between PZ and TZ (i.e. surgical capsule).
- A complete capsule is their main feature, similar to typical BPH nodules in the TZ.
- Multiplanar T2WI can help identify the capsule.
- These nodules are scored as PI-RADS assessment category 2.



Ectopic BPH nodule (arrow) in the right PZ.

Ectopic BPH

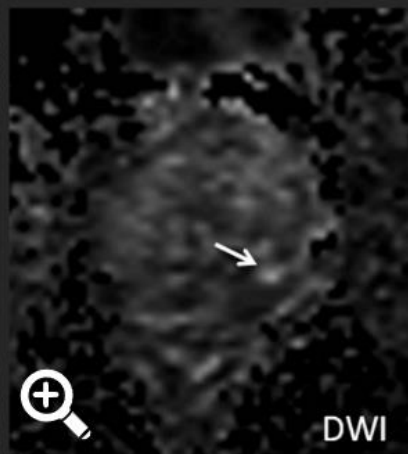
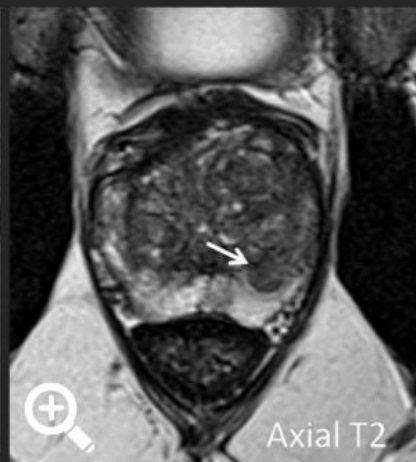
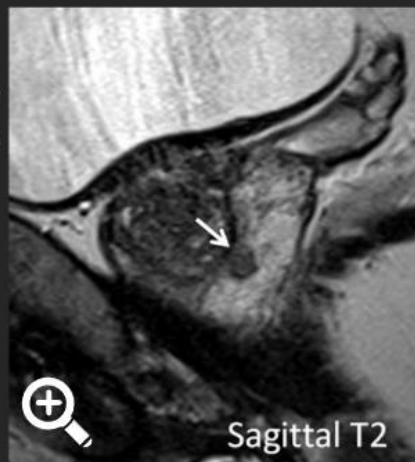
- BPH nodules can be located in the PZ, often abutting the interface between PZ and TZ (i.e. surgical capsule).
- A complete capsule is their main feature, similar to typical BPH nodules in the TZ.
- Multiplanar T2WI can help identify the capsule.
- These nodules are scored as PI-RADS assessment category 2.



Ectopic BPH nodule (arrow) in the left PZ. In this case the capsule is better delineated on the sagittal T2WI.

Ectopic BPH

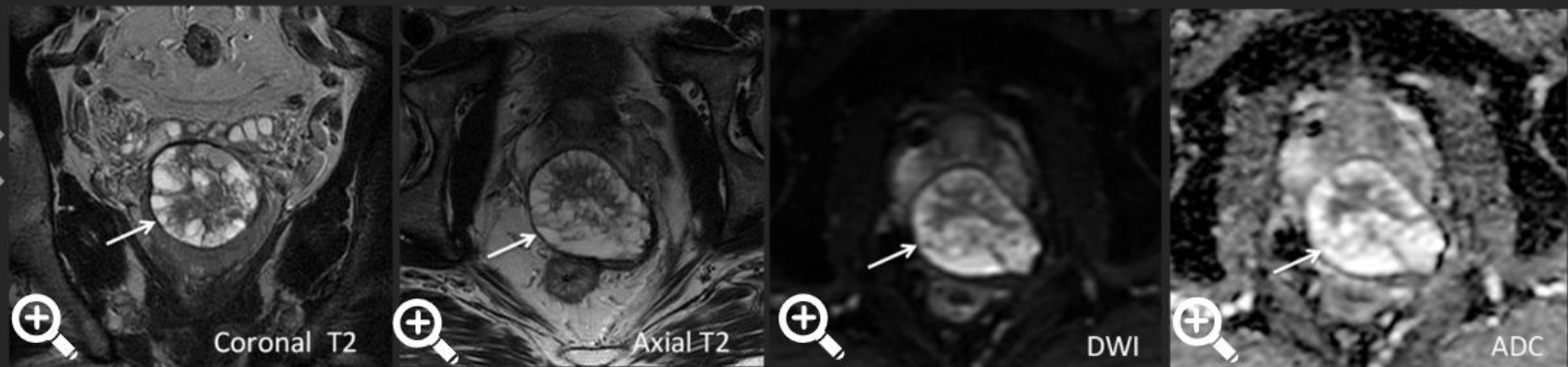
- BPH nodules can be located in the PZ, often abutting the interface between PZ and TZ (i.e. surgical capsule).
- A complete capsule is their main feature, similar to typical BPH nodules in the TZ.
- Multiplanar T2WI can help identify the capsule.
- These nodules are scored as PI-RADS assessment category 2.



Ectopic BPH nodule (arrow) in the left PZ. In this case the capsule is better delineated on the sagittal T2WI.

Stromal Tumor of Uncertain Malignant Potential (STUMP)

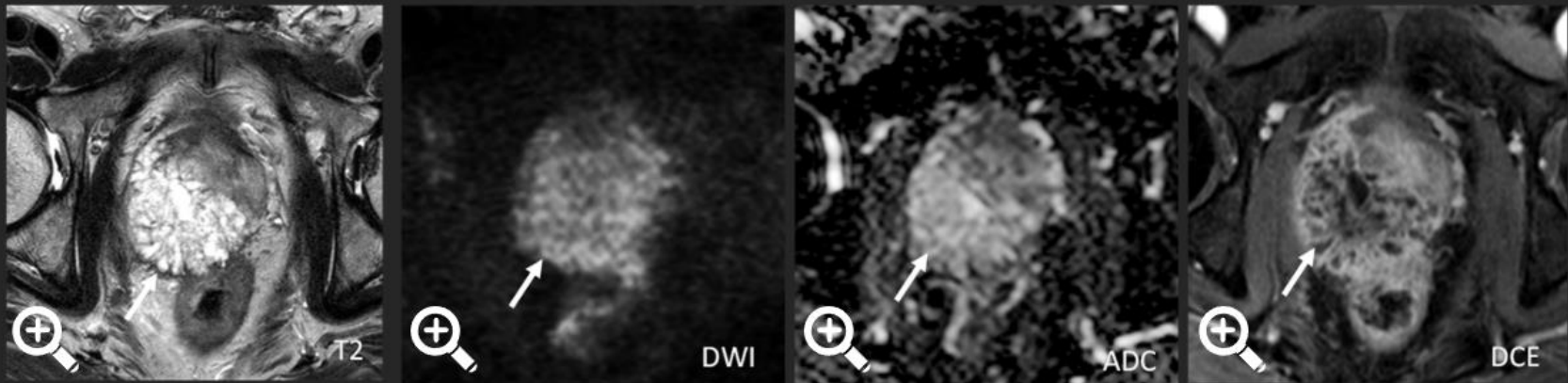
- Rare tumors that can harbor sarcoma.
- Often have mixed hyperintense and hypointense signal on T2WI with variable levels of restricted diffusion and enhancement.
- Appearance can resemble an ectopic BPH nodule although usually larger.



Large lesion (arrows) exophytic off the prostate with areas high and intermediate signal intensity on T2WI. There is also mixed high and low signal intensity on DWI and ADC map. While this tumor's name is "stromal tumor of uncertain malignant potential", this is a term used for needle biopsy specimens where it is not known if there is a sarcoma component not sampled. Once the tumor has been excised and there is no evidence of sarcoma, as seen in this case, the lesion has an expected benign clinical course.

Mucinous Adenocarcinoma

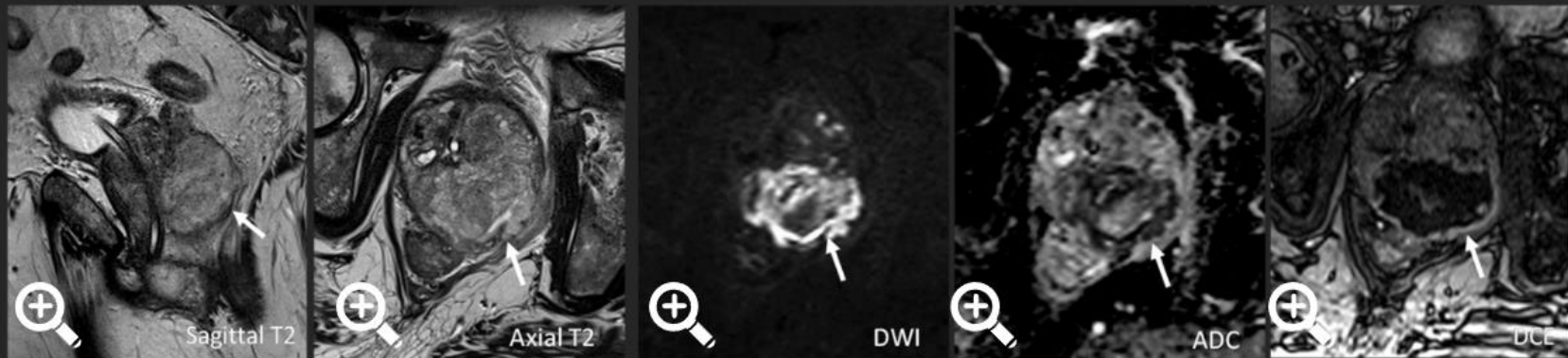
- Uncommon variant of prostate adenocarcinoma
- Demonstrate areas with hyperintense signal on T2WI due to mucinous content
- Can mimic cystic BPH and abscess



T2WI shows a large infiltrative tumor in the PZ and TZ with characteristic areas of hyperintense signal. The tumor has hyperintense signal on DWI and ADC map due to T2 shine through. On DCE the lesion has thin enhancing septations.

Prostatic Abscess

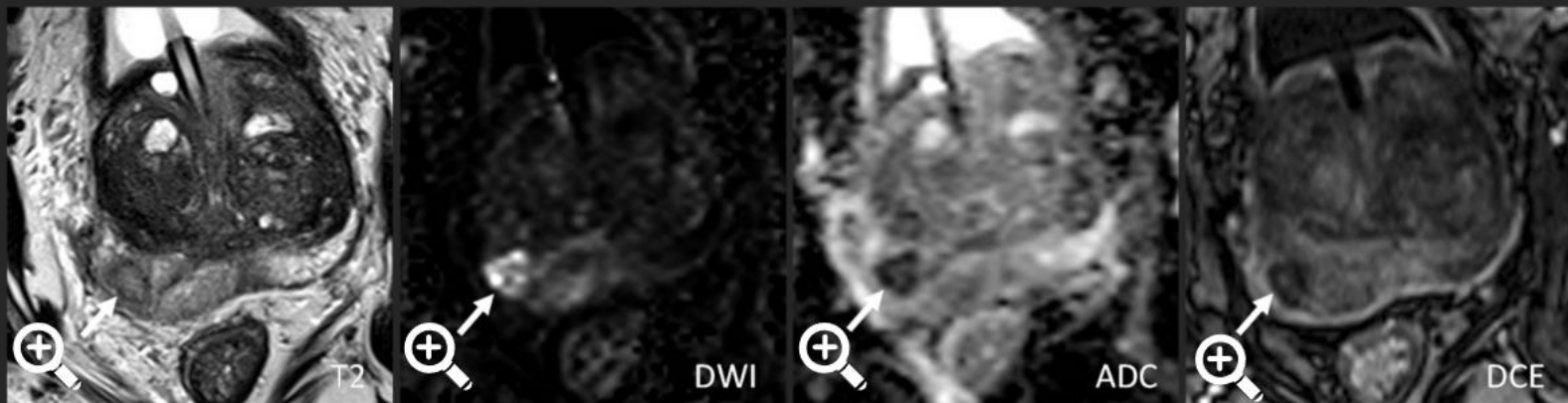
- Uncommon complication from prostatitis.
- MRI features include restricted diffusion in areas with high/intermediate signal intensity on T2WI and rim-enhancement on DCE.
- Can be single or multiple and affect the PZ, TZ or both.



T2WI shows a large abscess (arrow) causing bulging of the prostate capsule. The abscess content shows heterogenous high/intermediate signal intensity and restricted diffusion. On DCE, the abscess cavity shows rim enhancement.

Prostatic Abscess

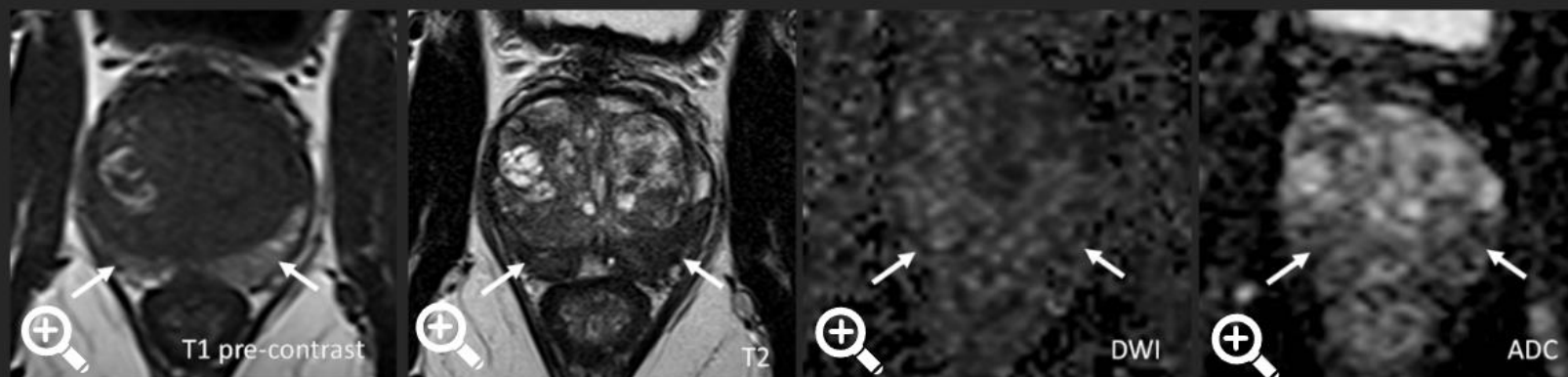
- Uncommon complication from prostatitis.
- MRI features include restricted diffusion in areas with high/intermediate signal intensity on T2-WI and rim-enhancement on DCE.
- Can be single or multiple and affect the PZ, TZ or both.



T2WI shows a small abscess (arrow) in the right PZ. The abscess content shows heterogenous high/intermediate signal intensity and restricted diffusion. On DCE, there is peripheral enhancement.

Post-biopsy Hemorrhage

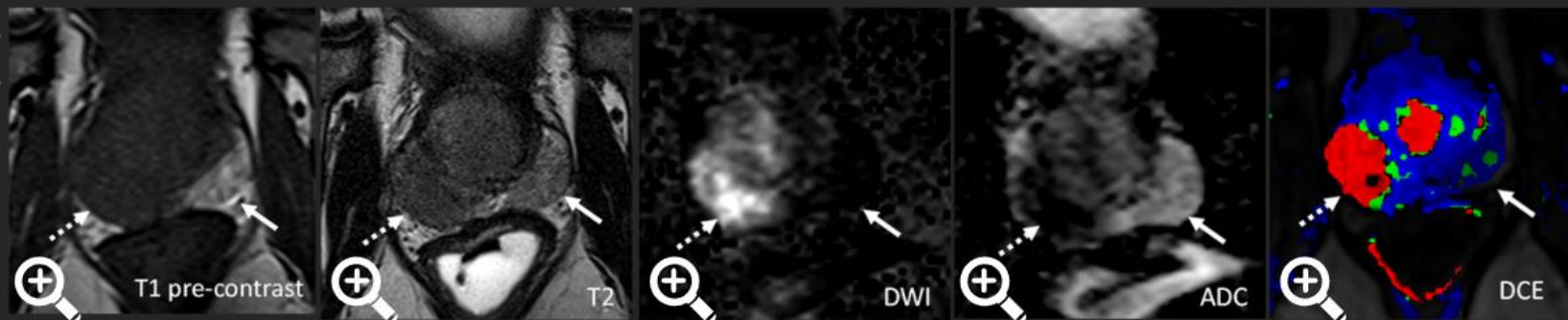
- Blood products can accumulate in the prostate for weeks to months post biopsy due to the presence of Citrate, a metabolite in benign prostatic tissue that has anti-coagulant properties.
- Since cancerous tissue is devoid of Citrate, hemorrhage does not persist in cancer (hemorrhage exclusion sign).
- Hyperintense signal on T1WI is the hallmark of post-biopsy hemorrhage in the prostate.



Hyperintense T1WI signal in the PZ (arrows) represents post biopsy hemorrhage in tissue containing no cancer. Notice that hemorrhage is also associated with hypointense signal on T2WI and ADC map, but without hyperintense signal on DWI.

Post-biopsy Hemorrhage

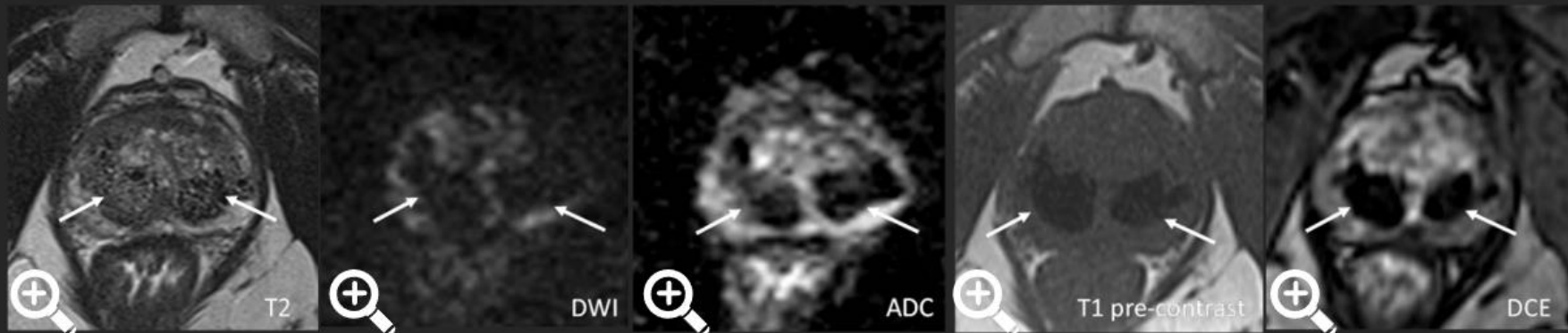
- Blood products can accumulate in the prostate for weeks to months post biopsy due to the presence of Citrate, a metabolite in benign prostatic tissue that has anti-coagulant properties.
- Since cancerous tissue is devoid of Citrate, hemorrhage does not persist in cancer (hemorrhage exclusion sign).
- Hyperintense signal on T1WI is the hallmark of post-biopsy hemorrhage in the prostate.



Hyperintense T1W signal in the left PZ (solid arrow) represents post biopsy hemorrhage in tissue containing no cancer. A PI-RADS 5 lesion on the right (dotted arrow) is spared from the hemorrhage and has hypointense signal on T1WI.

Prostatic Calcifications

- Originate from precipitation of prostatic secretions or calcification of the corpora amylacea.
- No clinical significance in most patients.
- Can interfere with high intensity focused ultrasound (HIFU) treatment for prostate cancer.
- Commonly detected on CT and US, but not always detected by MRI.
- When visible, they have low signal on T2WI, DWI/ADC map and no enhancement on DCE.



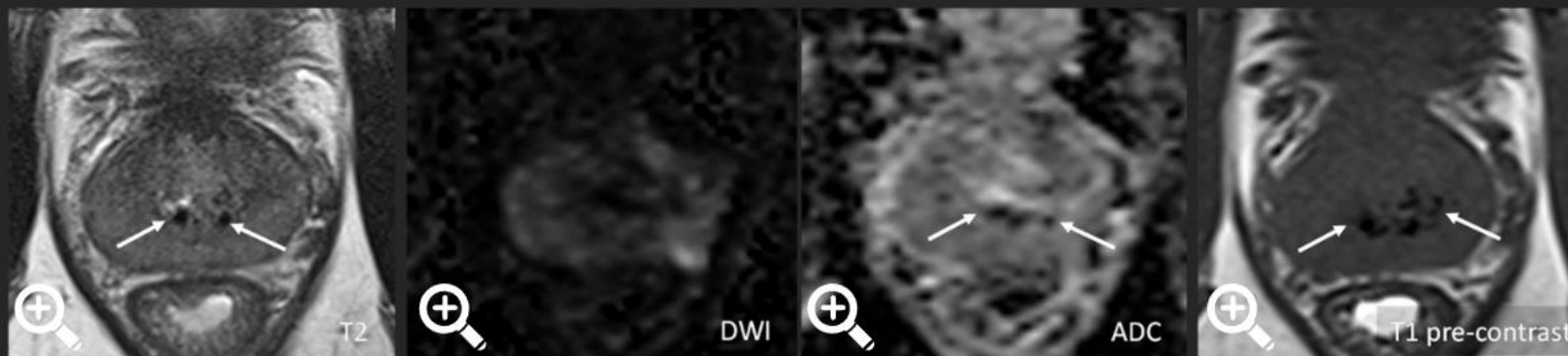
Clustered calcifications in the transition zone (arrows) have hypointense signal on T2WI, DWI/ADC, and T1WI, and no enhancement on DCE images.

Corresponding non-contrast CT image



Prostatic Calcifications

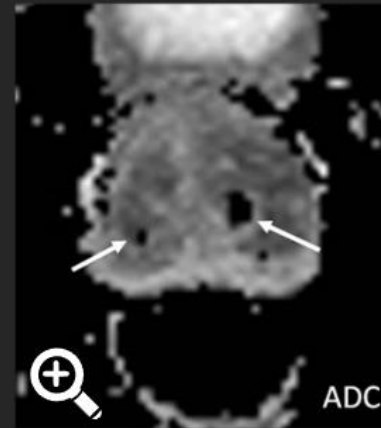
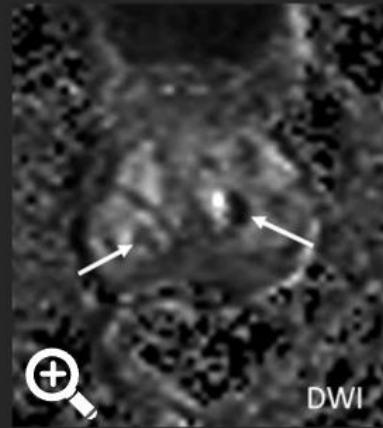
- Originate from precipitation of prostatic secretions or calcification of the corpora amylacea.
- No clinical significance in most patients.
- Can interfere with high intensity focused ultrasound (HIFU) treatment for prostate cancer.
- Commonly detected on CT and US, but not always detected by MRI.
- When visible, they have low signal on T2WI, DWI/ADC map and no enhancement on DCE.



Patient with chronic prostatitis and calcifications in the transition zone (arrows) that have hypointense signal on T2WI and DWI/ADC. On T1WI pre-contrast the calcifications are better visualized and also have hypointense signal.

Prostatic Calcifications

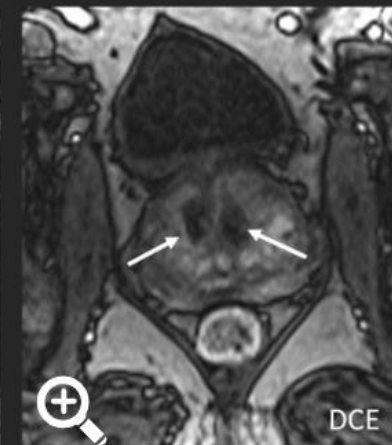
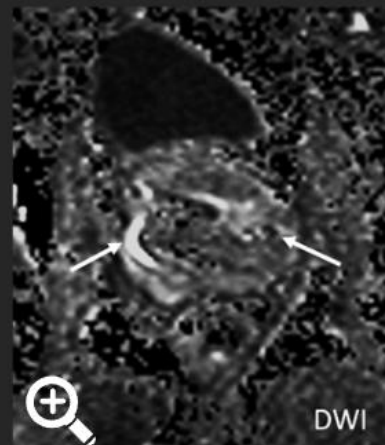
- Originate from precipitation of prostatic secretions or calcification of the corpora amylacea.
- No clinical significance in most patients.
- Can interfere with high intensity focused ultrasound (HIFU) treatment for prostate cancer.
- Commonly detected on CT and US, but not always detected by MRI.
- When visible, they have low signal on T2WI, DWI/ADC map and no enhancement on DCE.



Calcifications in the transition zone (arrows) have hypointense signal on T2WI and DWI/ADC and mildly hyperintense signal on T1WI.

Prostatic Urethral Lift (PUL) Procedure

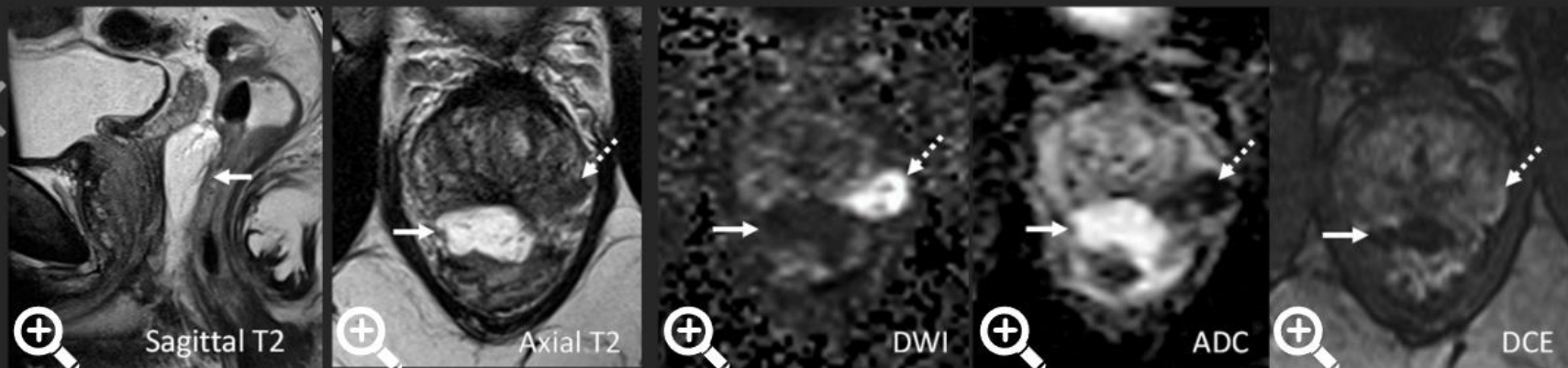
- Non-pharmacological alternative to treat BPH symptoms.
- Permanent implants used to retract obstructing prostatic tissue allowing expansion of the prostatic urethral lumen.
- Implant is considered MRI-safe but can cause substantial susceptibility artifacts, especially on DWI.
- Can be confused with fiducial markers used in radiation therapy and brachytherapy seeds.



Prostatic urethral lift device in the TZ (arrows) causes susceptibility artifacts with significant distortion of DWI and ADC map.

Prostate Rectal Spacer

- Used to create space between the prostate and rectum prior to radiation treatment of prostate cancer to reduce rectal radiation exposure and toxicity.
- Water (90%) mixed with polyethylene glycol: T2WI hyperintense signal.
- Should not be confused with mucinous tumors or abscess.



The hydrogel (solid arrow) has hyperintense signal on T2WI, hypointense signal on DWI, hyperintense signal in the ADC map and no enhancement on DCE. A PI-RADS 5 lesion (dotted arrow) is present in the left PZ.

Which PI-RADS assessment category should be assigned for the abnormalities in the PZ?

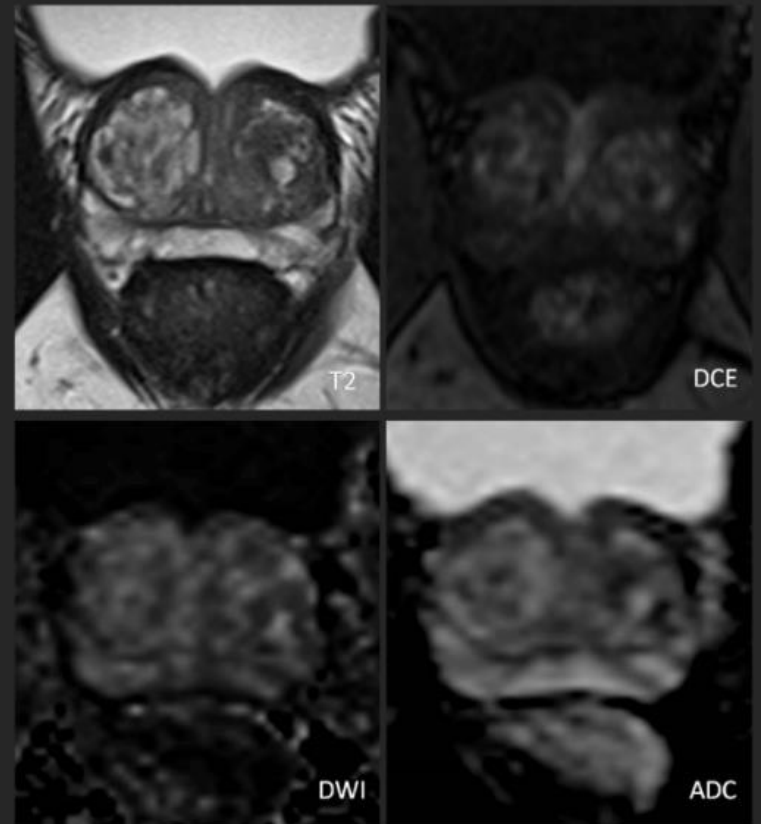
A. PI-RADS 1

B. PI-RADS 2

C. PI-RADS 3

D. PI-RADS 4

E. PI-RADS 5



Question 1 of 5

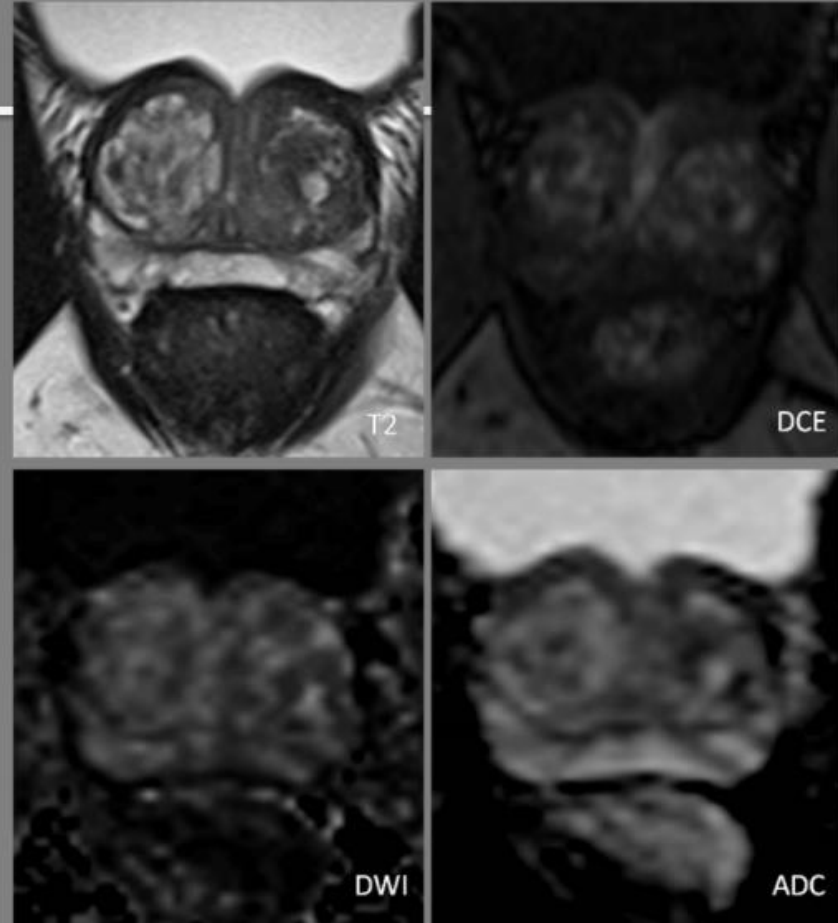
Submit

Correct

B. PI-RADS 2

That's right! Linear and wedge-shaped lesion in the PI-RADS receive a DWI/ADC score 2 and the final PI-RADS assessment category is also 2.

Continue



Which of the following conditions can be seen with granulomatous prostatitis?

A. BCG therapy for bladder cancer

B. Wegner's granulomatosis

C. Sarcoidosis

D. Fungal Infections

E. All the above

E. All the above

Correct

That's right! All the conditions listed can cause granulomatous prostatitis.

Which PI-RADS assessment category should be assigned to this PZ abnormality?

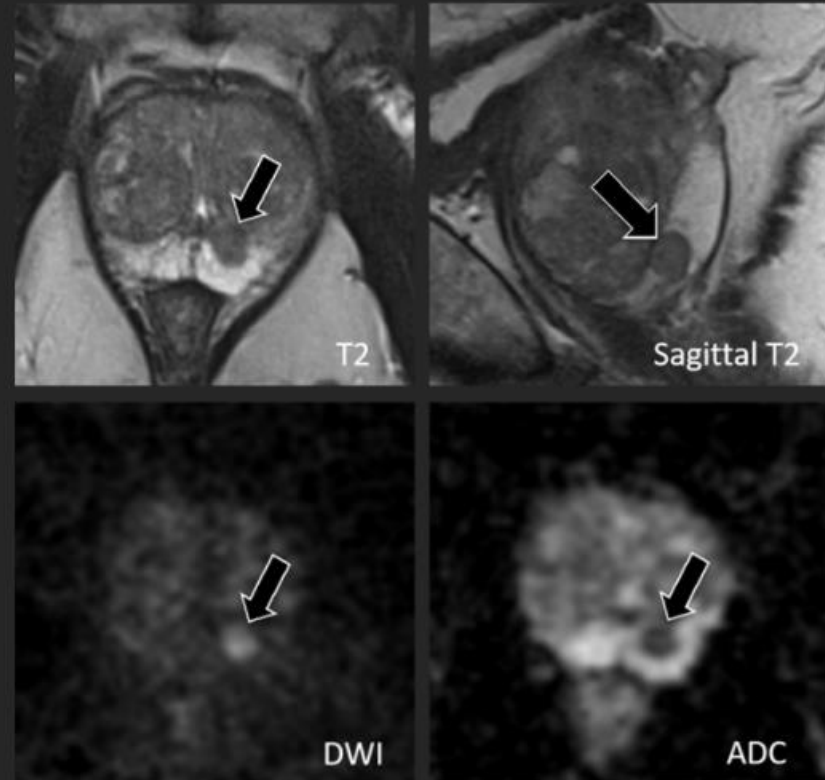
A. PI-RADS 1

B. PI-RADS 2

C. PI-RADS 3

D. PI-RADS 4

E. PI-RADS 5



Question 3 of 5

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Correct

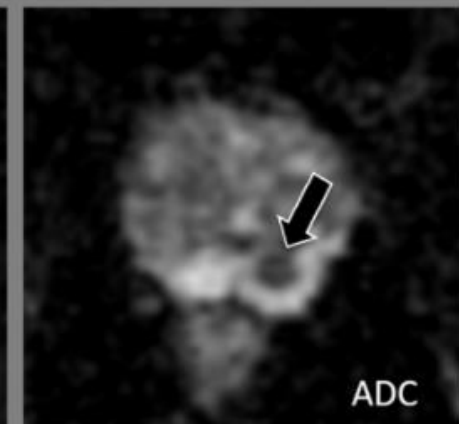
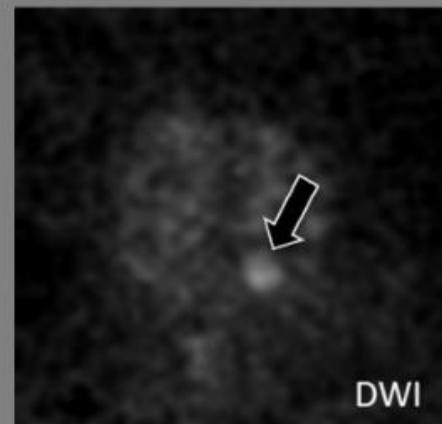
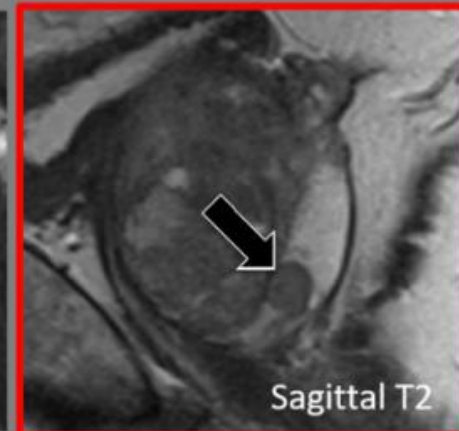
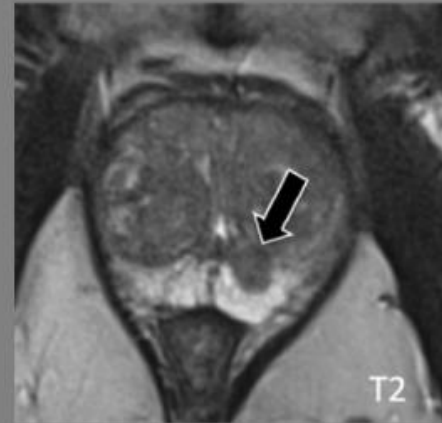
B. PI-RADS 2

That's right!

Answer: b. PI-RADS 2

Explanation: Ectopic BPH nodules in the PZ are assigned a PI-RADS assessment category 2. Please note well-defined encapsulation of the extruded/ectopic BPH nodule in left PZ and its T2 signal similarity to other BPH nodules within TZ .

Continue



Which of the following MR sequences is used to distinguish prostate cancer from post-biopsy changes?

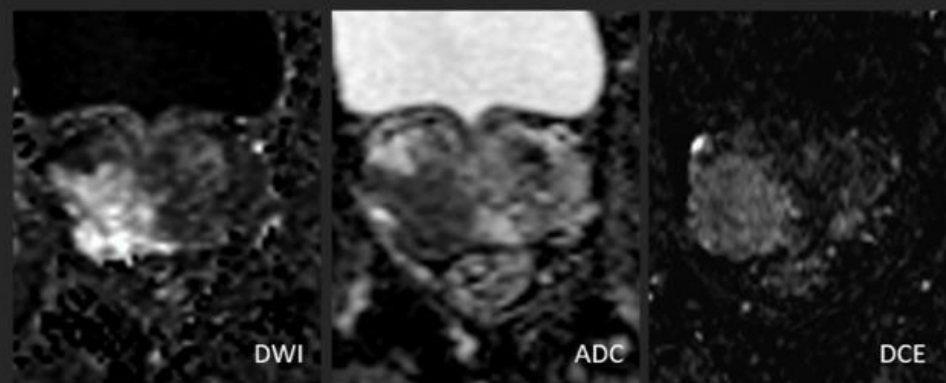
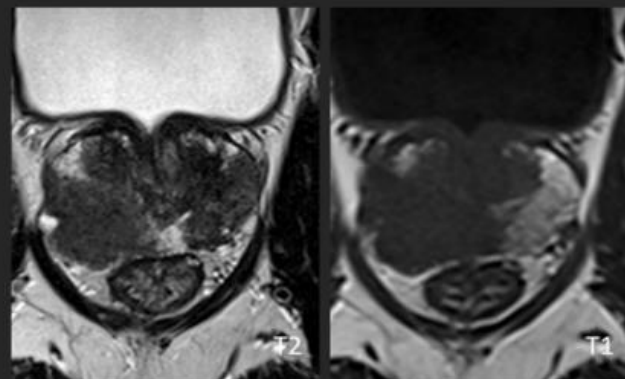
A. T2WI

B. High b-value DWI

C. ADC map

D. T1WI pre-contrast

E. Delayed post-contrast T1WI



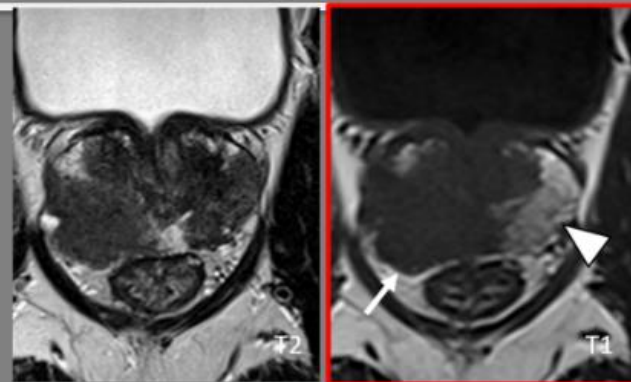
Question 4 of 5

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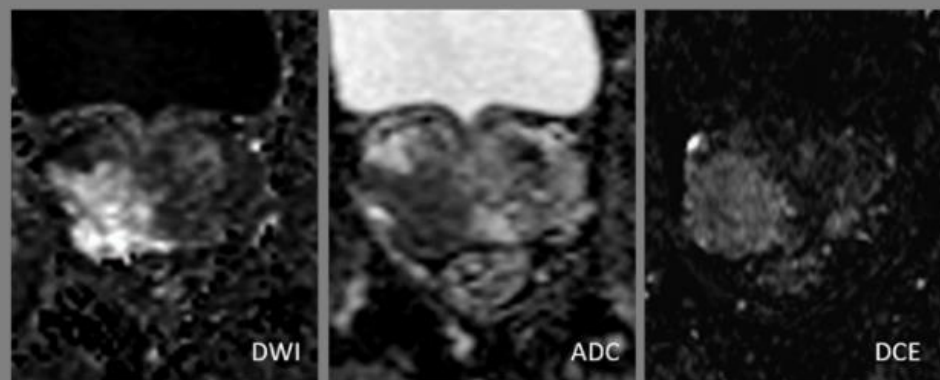
Correct

D. T1WI pre-contrast

Correct! The correct answer is d. T1WI pre-contrast - Post biopsy hemorrhage (arrowhead) in noncancerous tissues has hyperintense signal on T1WI, while prostate cancer (arrow) is usually spared from hemorrhage and shows isointense signal on T1WI.



Continue



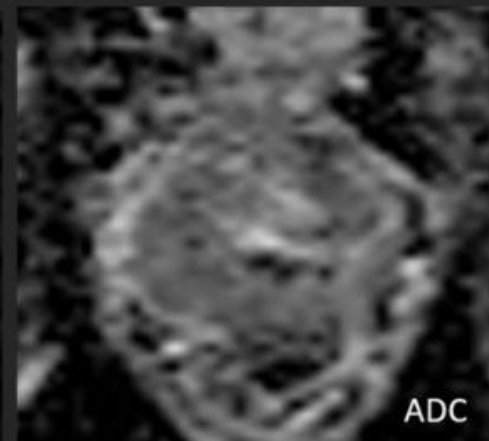
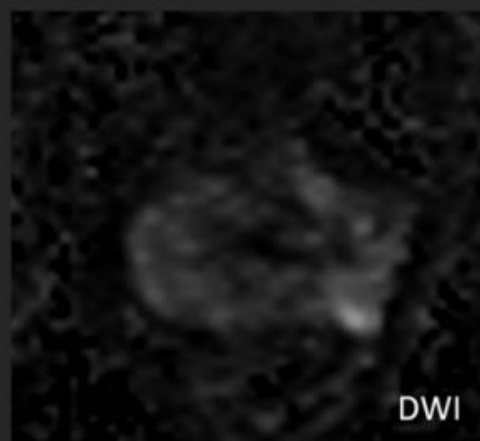
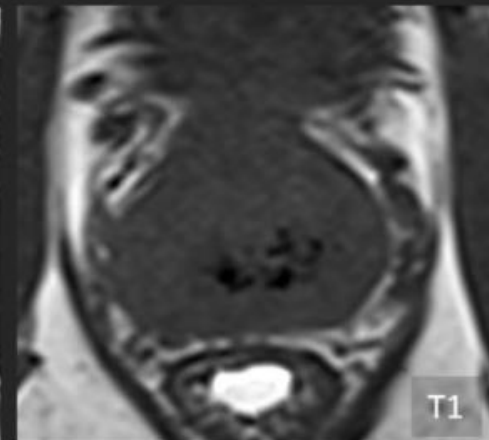
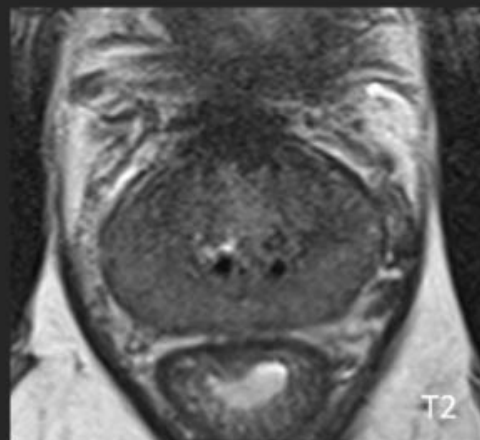
In which MR sequence calcifications tend to be most conspicuous?

A. T1WI

B. T2WI

C. DWI

D. ADC map



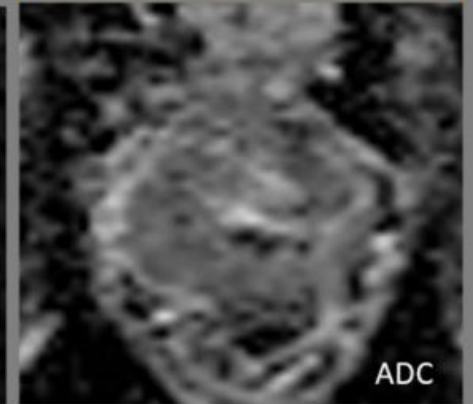
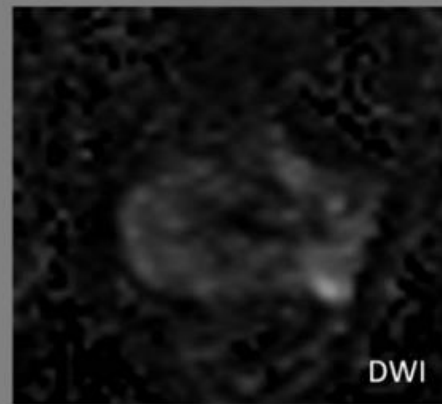
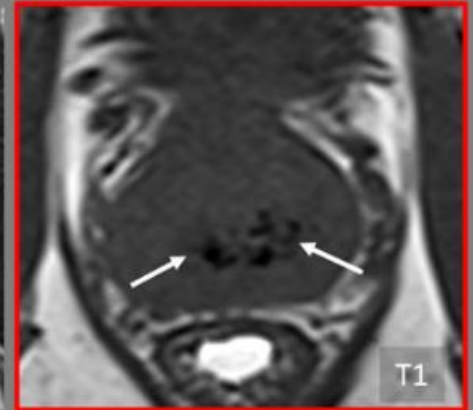
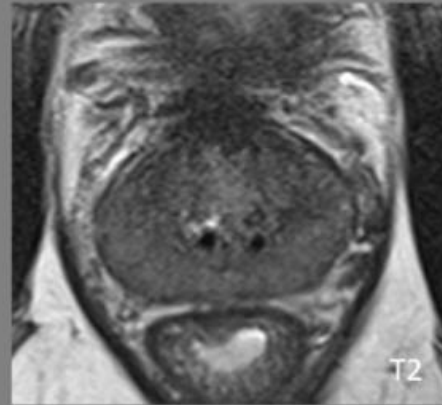
Question 5 of 5

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Correct

A. T1WI

Correct! The correct answer is a. T1WI
Calcifications tend to be best seen on T1WI gradient echo GRE images (arrows) or susceptibility-weighted images SWI (not shown).



[Return to Menu](#)

Staging

- Prostate cancer staging is important to predict the patient's prognosis and to assist in treatment selection and planning.
- The clinical T stage is based on digital rectal exam (DRE) and any other tests performed prior to definitive treatment.

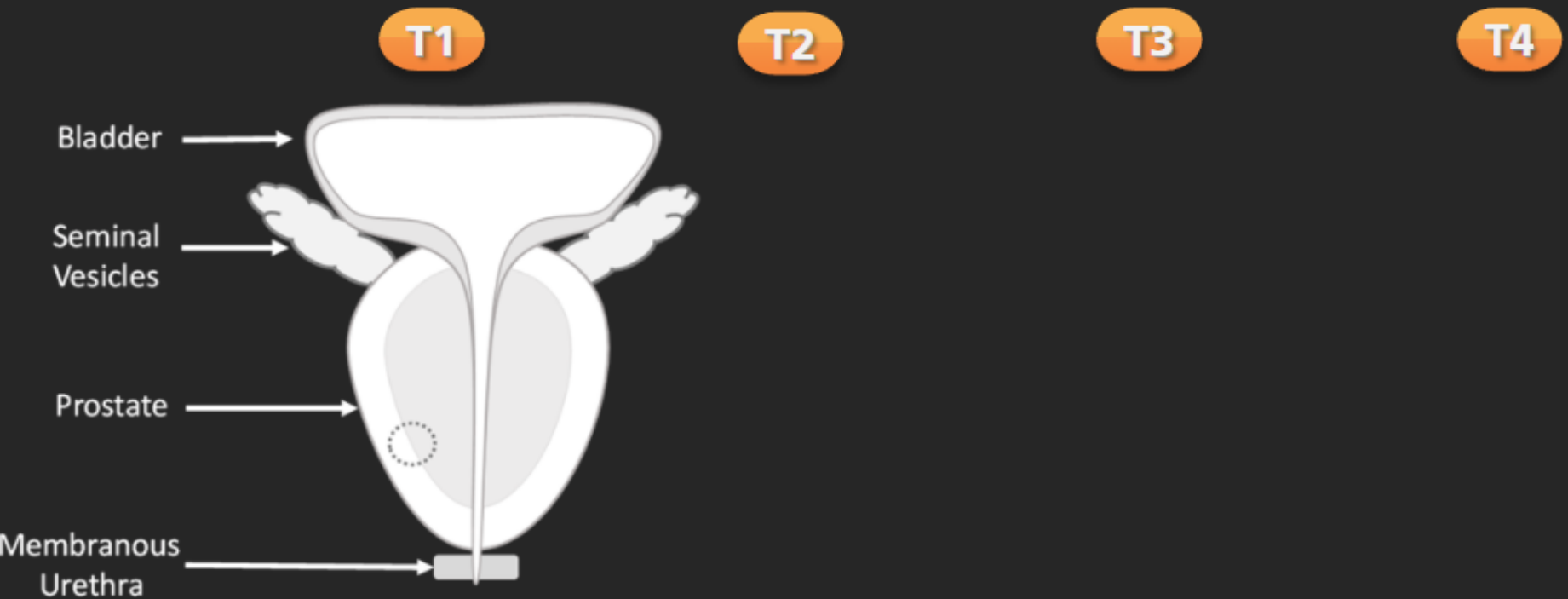
Click on each button to learn more about clinical staging.

T1

T2

T3

T4



➤ T1: Cancer cannot be felt on exam and is not visible on imaging

T1

T2

T3

T4



- T2: Cancer can be felt on exam or visible on imaging and is confined to the prostate.

T1

T2

T3

T4



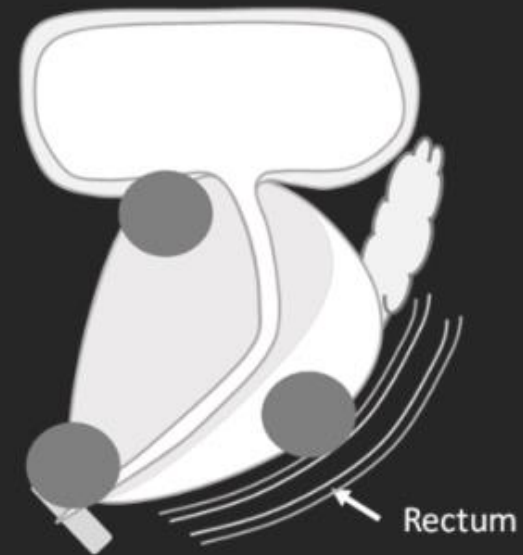
- T3: Cancer extends outside of the prostate.
T3a: Cancer does not invade seminal vesicle.
T3b: Cancer invades seminal vesicle.

T1

T2

T3

T4



- T4: Cancer invades adjacent organs (e.g., membranous urethra, bladder and rectum).

- MRI is considered an appropriate method for determination of the tumor's T stage as either organ confined ($\leq T2$) or extending beyond the gland ($\geq T3$).

- MRI can also assist in the assessment of invasion of the neurovascular bundle (NVB), seminal vesicles (SV) and other neighboring structures.

- Accurate evaluation of extra-prostatic extension (EPE) with MRI requires T2WI with high spatial resolution, which is supplemented by information provided by DWI and DCE imaging.

- Imaging features used to assess for EPE include:
 - Tumor-capsule interface >1.0 cm
 - Bulging prostatic contour
 - Irregular or spiculated margin
 - Obliteration of the rectoprostatic angle
 - Breach of the capsule with evidence of direct tumor extension

Case

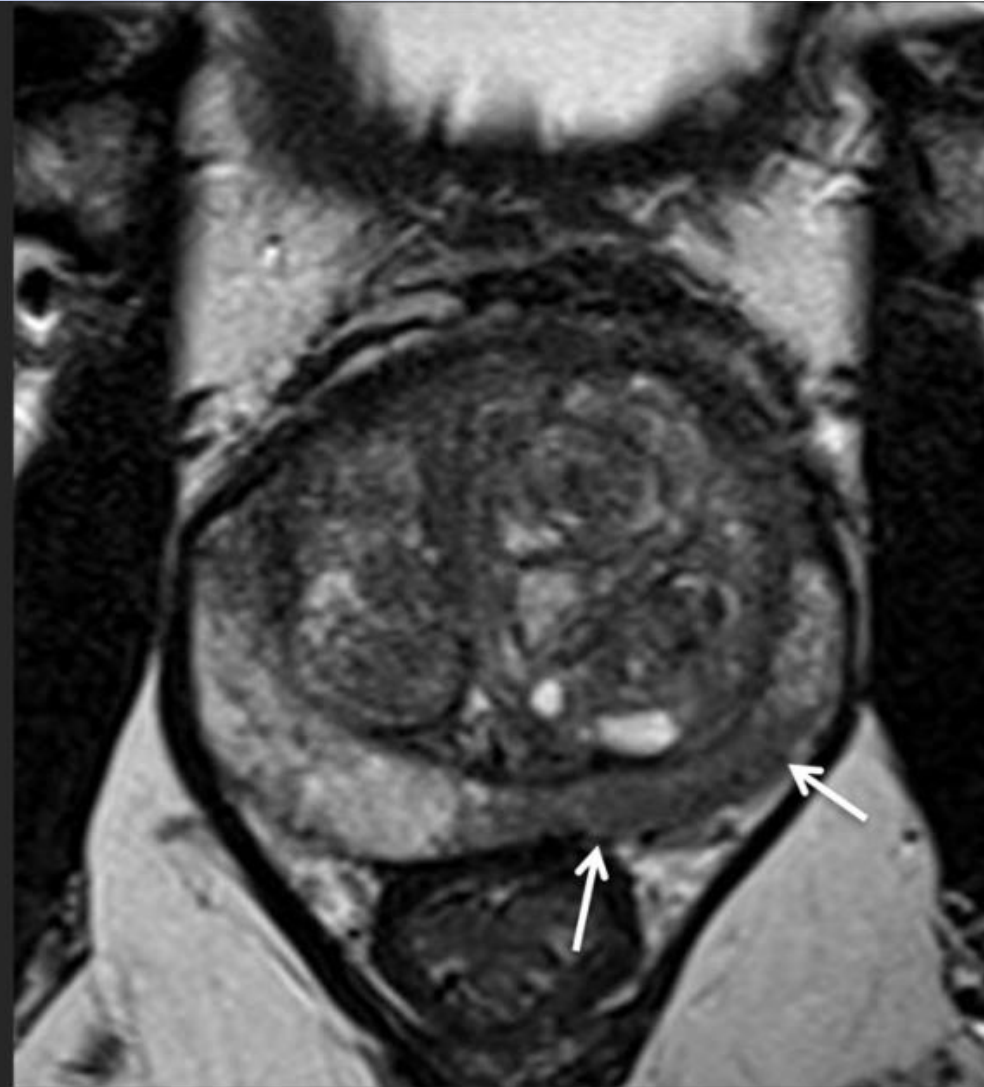
1

2

3

4

5



Tumor-capsule interface >1.0 cm

Imaging features used to assess for EPE include:

- Tumor-capsule interface >1.0 cm
- Bulging prostatic contour
- Irregular or spiculated margin
- Obliteration of the rectoprostatic angle
- Breach of the capsule with evidence of direct tumor extension

Case 1 2 3 4 5

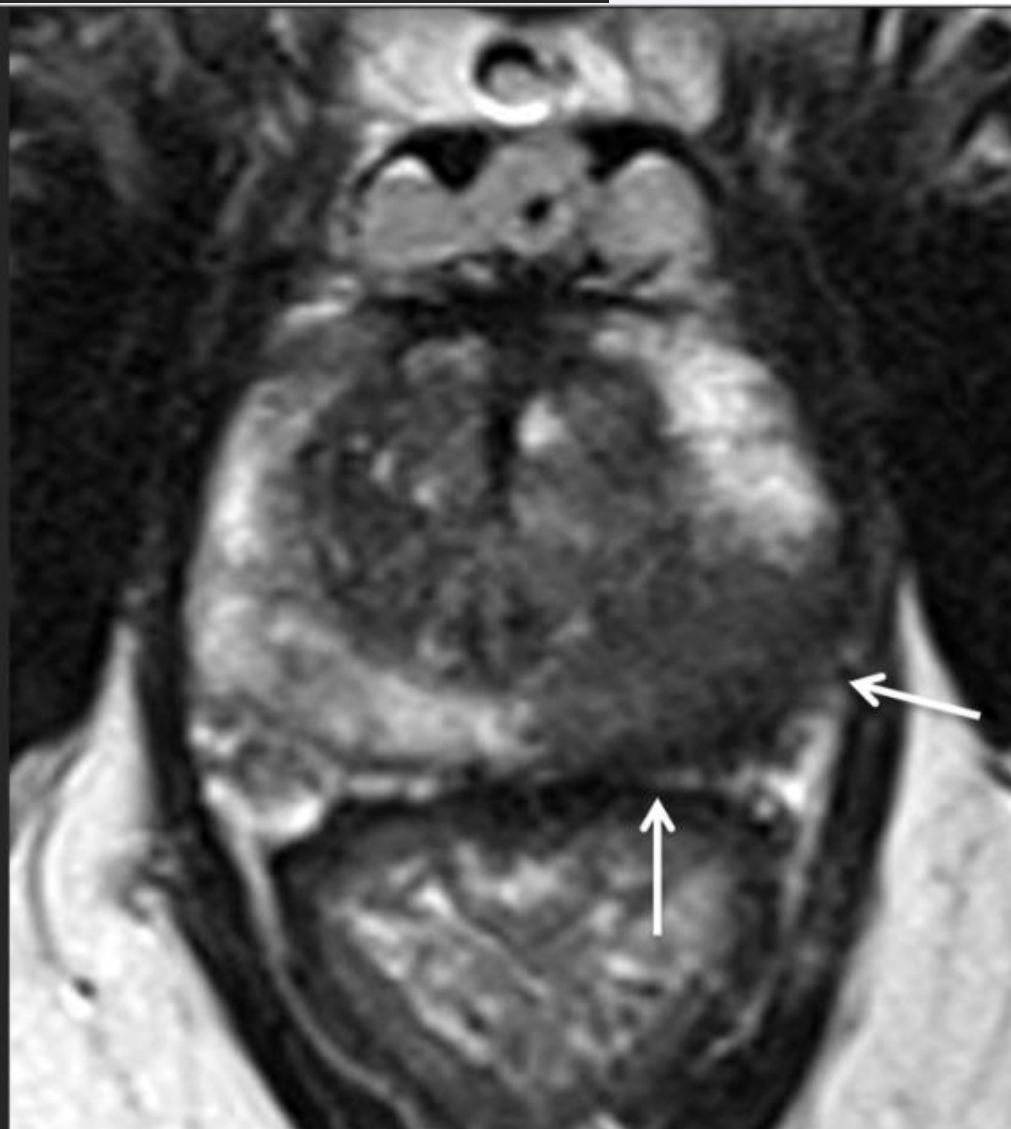


Bulging prostatic contour

Imaging features used to assess for EPE include:

- Tumor-capsule interface >1.0 cm
- Bulging prostatic contour
- Irregular or spiculated margin
- Obliteration of the rectoprostatic angle
- Breach of the capsule with evidence of direct tumor extension

Case 1 2 3 4 5

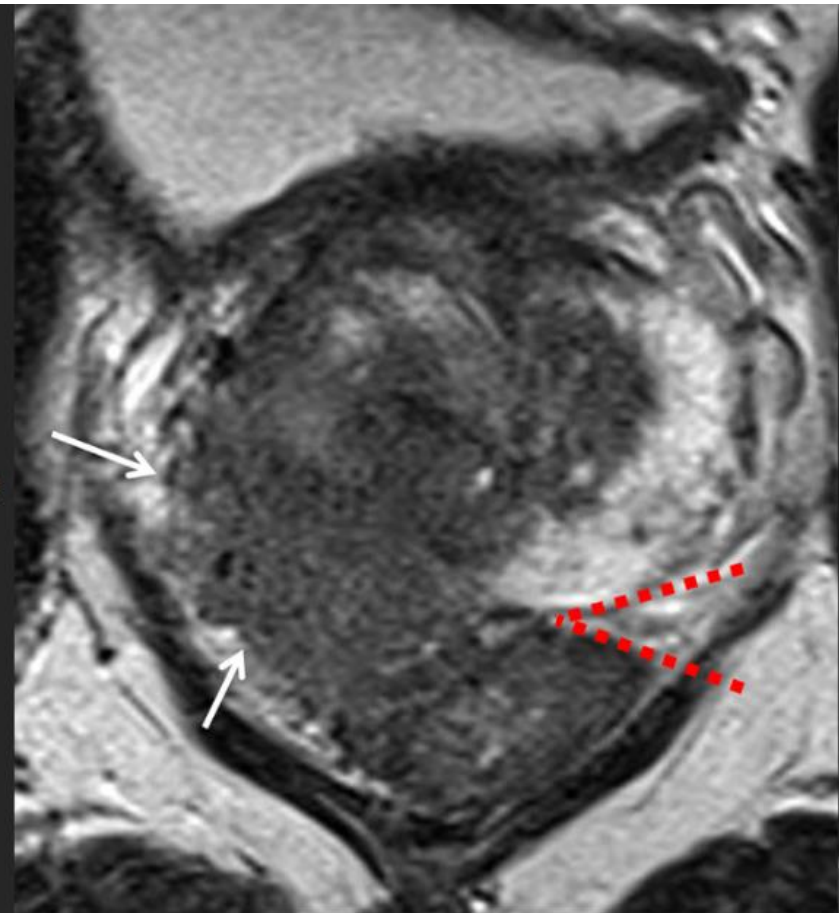


Irregular or spiculated margin

- Imaging features used to assess for EPE include:
 - Tumor-capsule interface >1.0 cm
 - Bulging prostatic contour
 - Irregular or spiculated margin
 - Obliteration of the rectoprostatic angle
 - Breach of the capsule with evidence of direct tumor extension

Case 1 2 3 **4** 5

The rectoprostatic angle is the space between the prostate and rectum (dotted lines on the left) where the neurovascular bundle is located.



Breach of the capsule with obliteration of the rectoprostatic angle.

Imaging features used to assess for EPE include:

- Tumor-capsule interface >1.0 cm
- Bulging prostatic contour
- Irregular or spiculated margin
- Obliteration of the rectoprostatic angle
- Breach of the capsule with evidence of direct tumor extension

Case

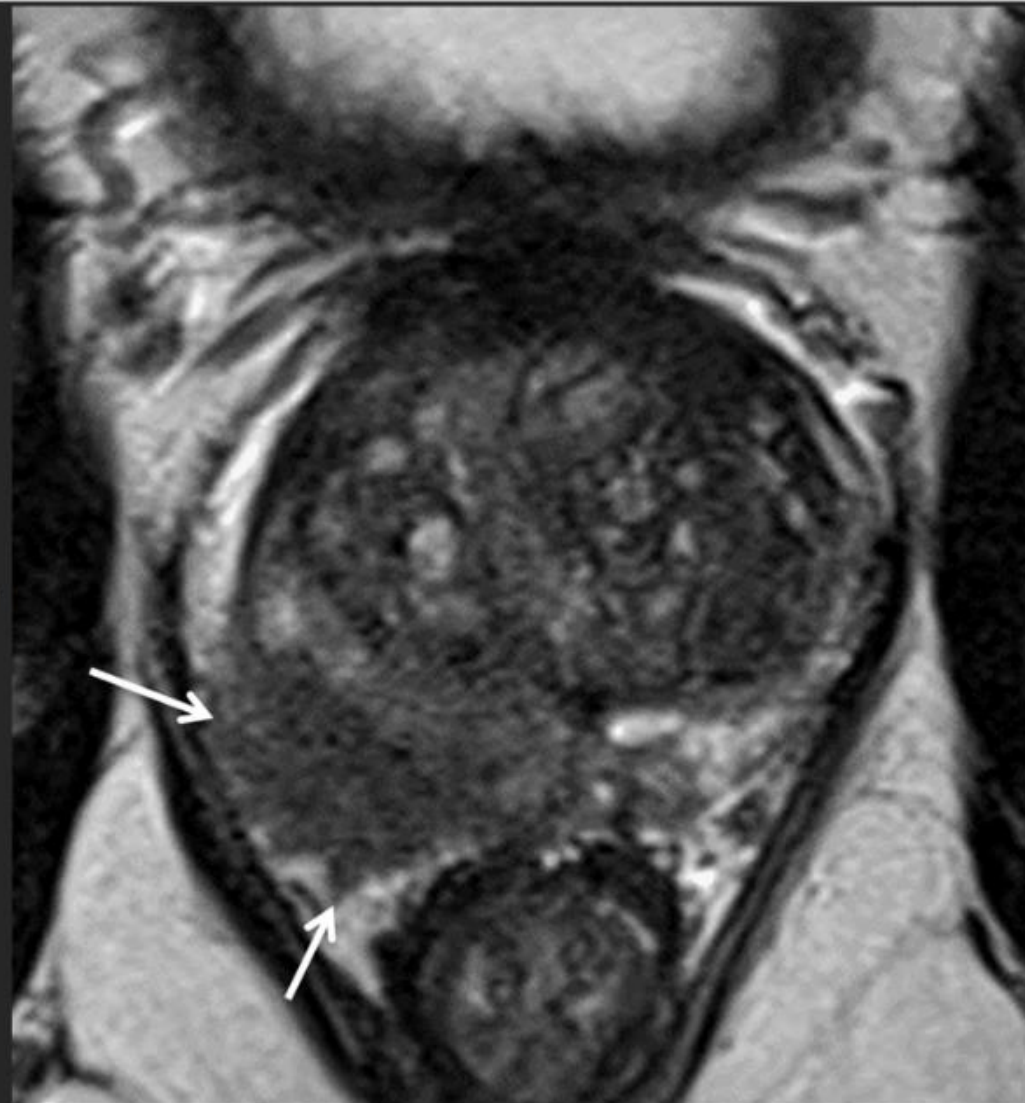
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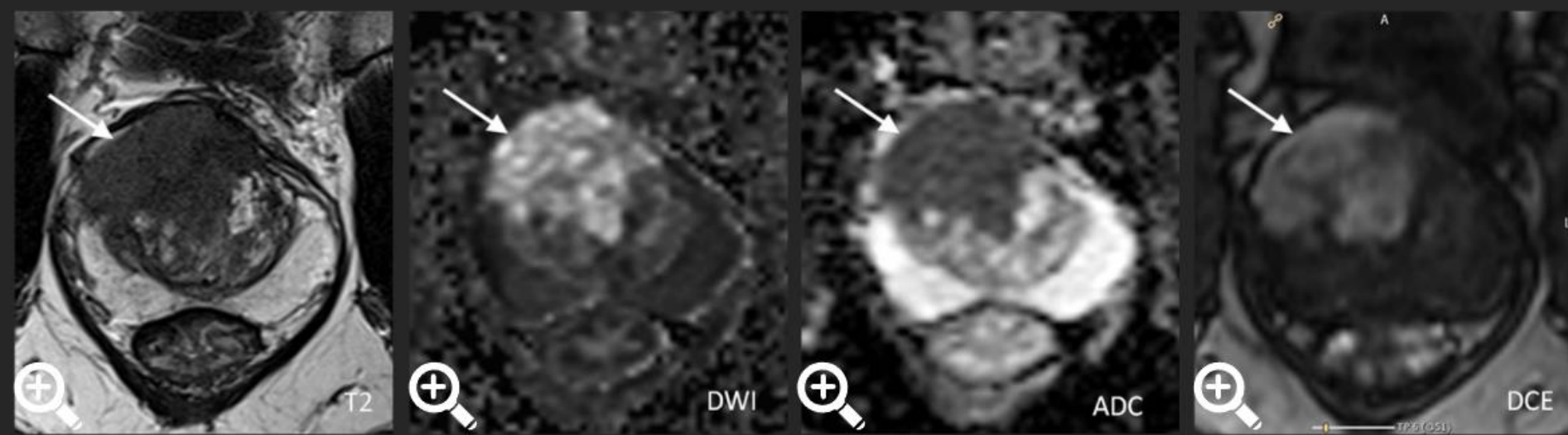
4

5



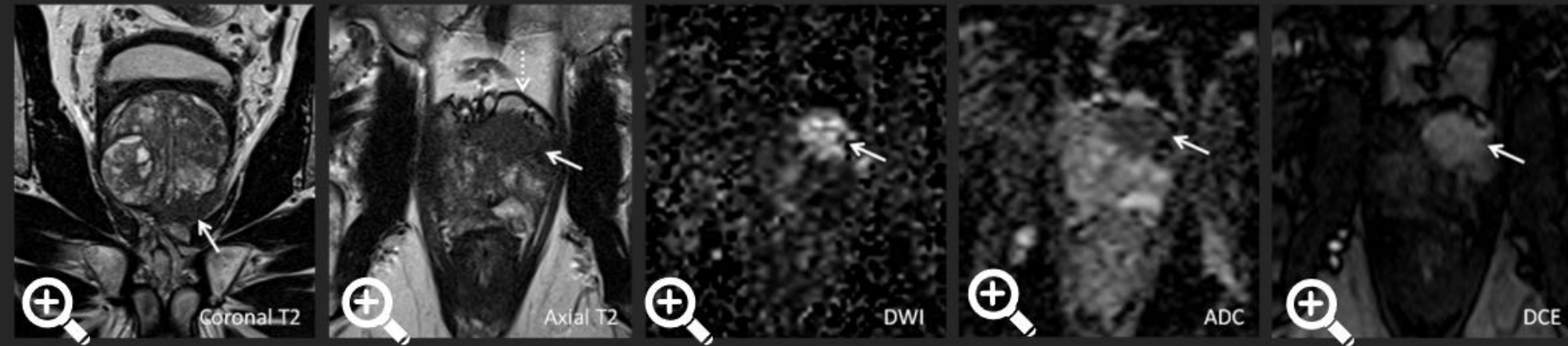
Breach of the capsule with obliteration of the rectoprostatic angle.

- Anteriorly, EPE occurs when the tumor extends beyond the anterior fibromuscular stroma (AFS).
- Tumors may extend into the anterior peri-prostatic venous plexus and urinary bladder.



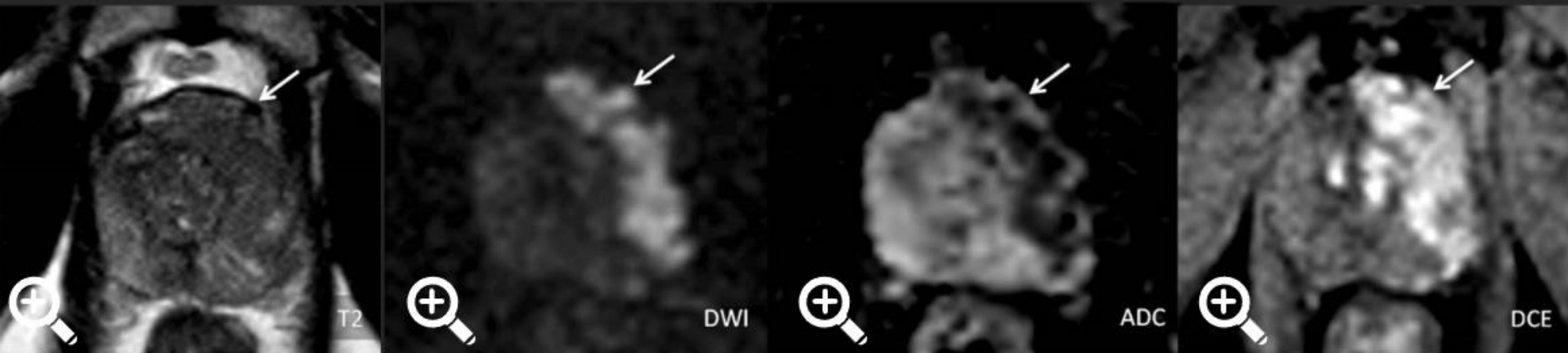
PI-RADS 5 lesion in the right anterior TZ (solid arrow) with extra-prostatic extension.

- Anteriorly, EPE occurs when the tumor extends beyond the anterior fibromuscular stroma (AFS).
- Tumors may extend into the anterior peri-prostatic venous plexus and urinary bladder.



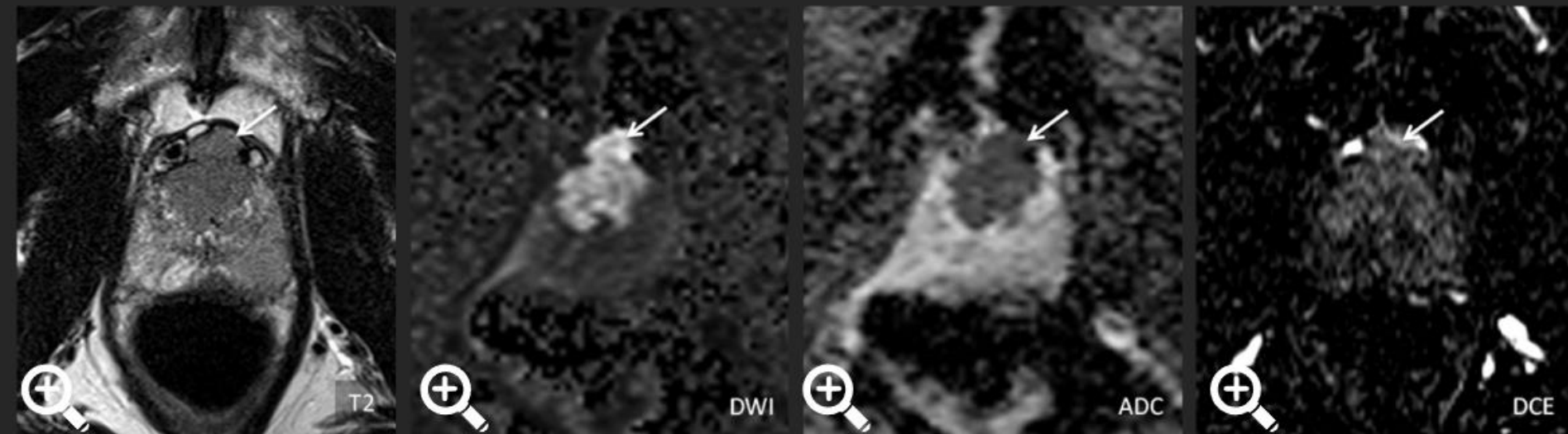
PI-RADS 5 lesion in the left anterior TZ (solid arrow) with extra-prostatic extension and invasion of the peri-prostatic venous plexus (dotted arrow).

- Anteriorly, EPE occurs when the tumor extends beyond the anterior fibromuscular stroma (AFS).
- Tumors may extend into the anterior peri-prostatic venous plexus and urinary bladder.



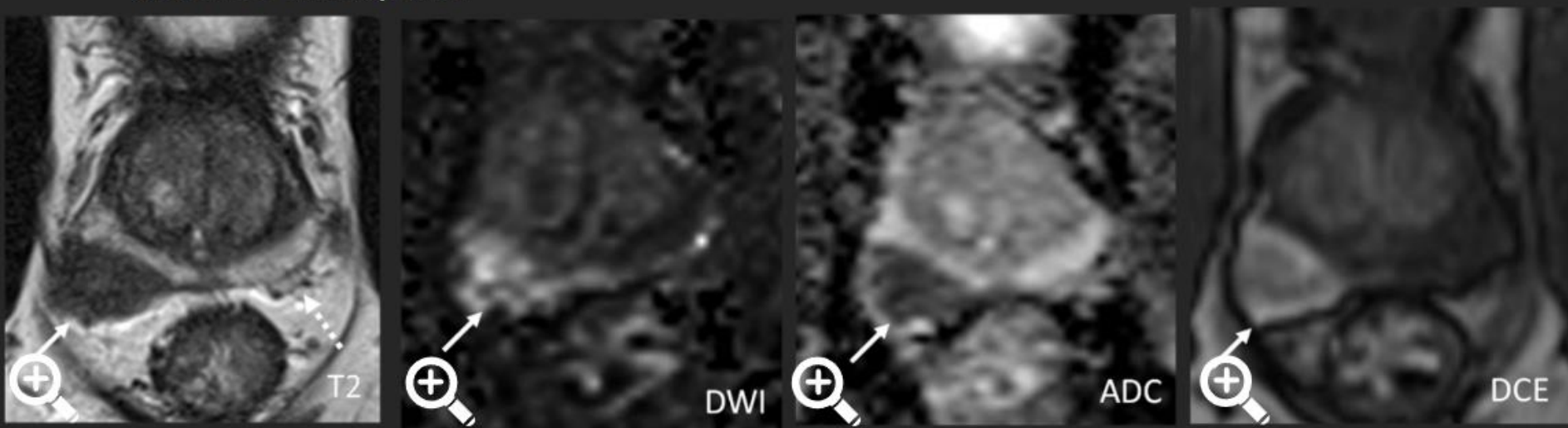
PI-RADS 5 lesion in the left anterior TZ (solid arrow) with extra-prostatic extension.

- Anteriorly, EPE occurs when the tumor extends beyond the anterior fibromuscular stroma (AFS)
- Tumors may extend into the anterior peri-prostatic venous plexus and urinary bladder.



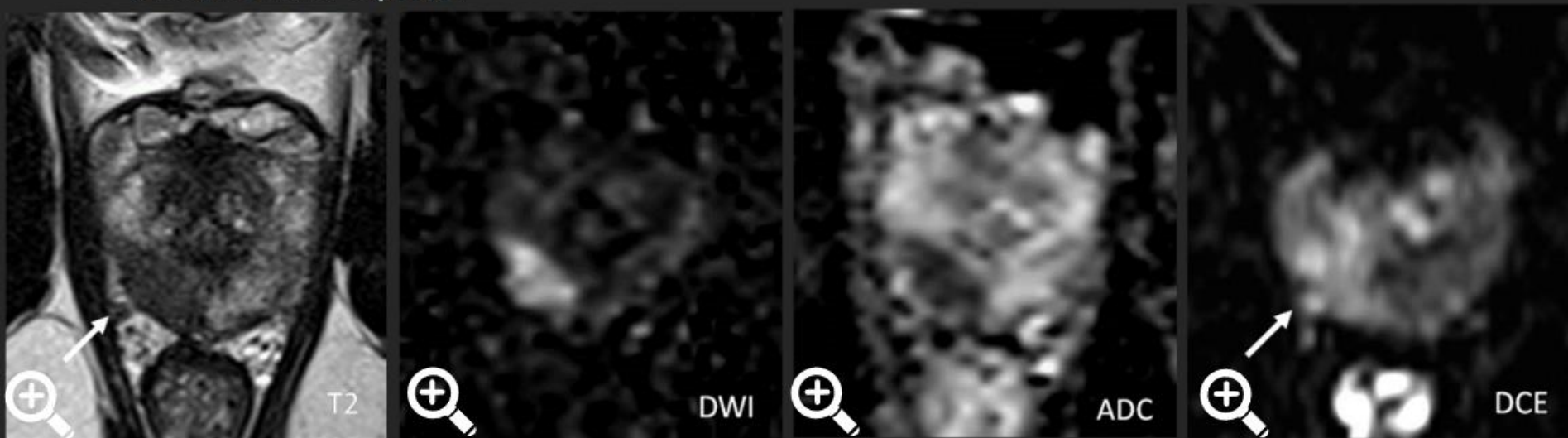
PI-RADS 5 lesion in the anterior TZ (solid arrow) with extra-prostatic extension.

- Assessment of NVB invasion is important to determine feasibility of nerve sparing radical prostatectomy and radiation treatment.
- NVB invasion is present when there is breach of the capsule and obliteration of the rectoprostatic angle.
- Thickening of the NVB adjacent to the tumor is an indirect sign of invasion in the absence of breach of the capsule.



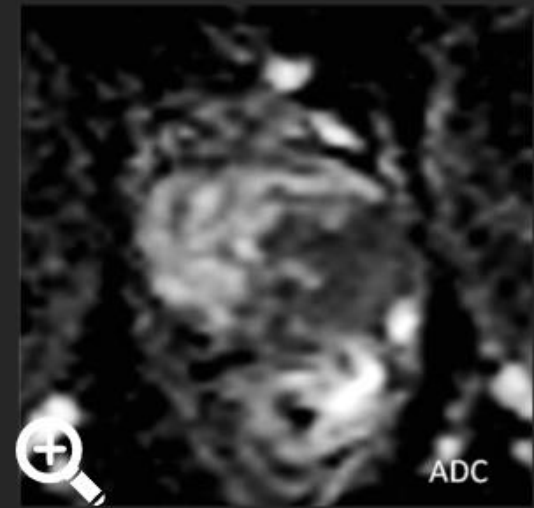
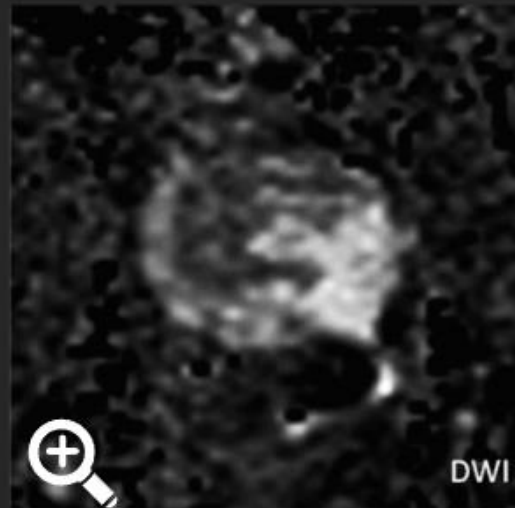
1.7-cm PI-RADS 5 lesion in the right PZ with EPE and NVB invasion (solid arrow).
Normal NVB on the left at 5 o'clock (dotted arrow).

- Assessment of NVB invasion is important to determine feasibility of nerve sparing radical prostatectomy and radiation treatment.
- NVB invasion is present when there is breach of the capsule and obliteration of the rectoprostatic angle.
- Thickening of the NVB adjacent to the tumor is an indirect sign of invasion in the absence of breach of the capsule.



Asymmetric thickening of the right NVB at 7 o'clock adjacent to a PI-RADS 5 lesion in the right PZ with broad (>1 cm) tumor-capsule interface.

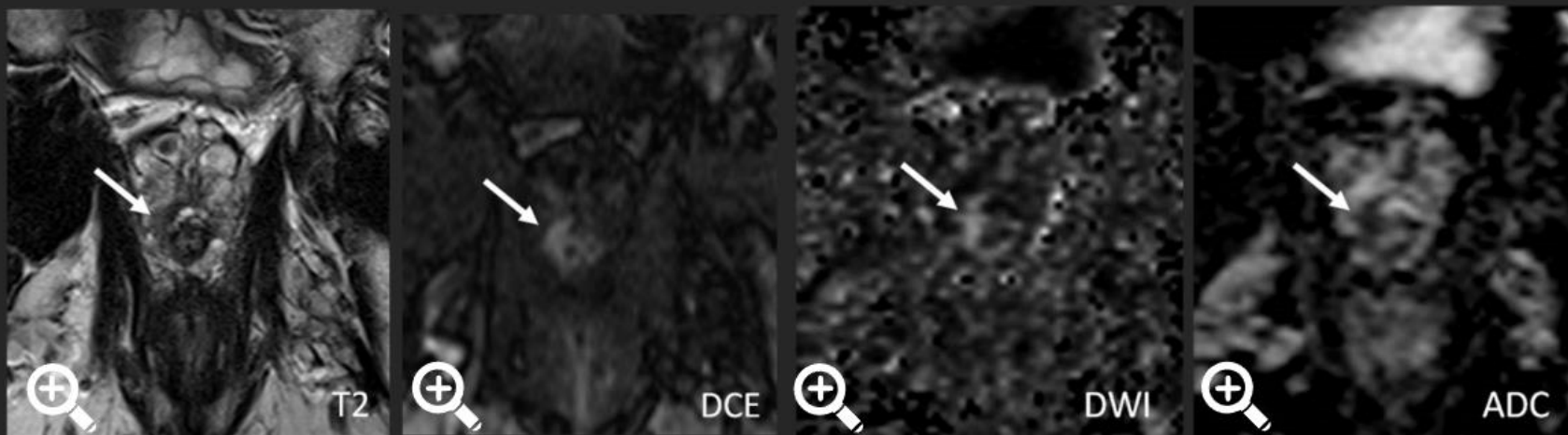
- Assessment of NVB invasion is important to determine feasibility of nerve sparing radical prostatectomy and radiation treatment.
- NVB invasion is present when there is breach of the capsule and obliteration of the rectoprostatic angle.
- Thickening of the NVB adjacent to the tumor is an indirect sign of invasion in the absence of breach of the capsule.



Asymmetric thickening of the left NVB adjacent to a PI-RADS 5 lesion in the left PZ and TZ with broad (>1 cm) tumor-capsule interface.

Apical Tumors

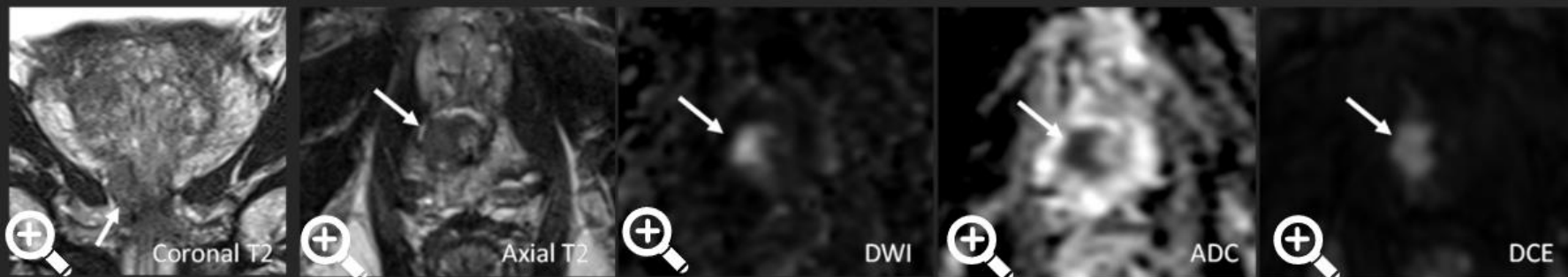
- PCa in the apex has similar mpMRI features compared to tumors in other locations, however, apical tumors are often difficult to detect and characterize due to volume averaging.
- These lesions are at risk for positive margin and recurrence after radical prostatectomy.
- Urethral invasion is considered invasive behavior (PI-RADS assessment category 5).



PI-RADS 4 lesion in the right apical region treated with RP.
Surgical pathology revealed Gleason score 4 + 3 PCa with EPE and positive margins.

Apical Tumors

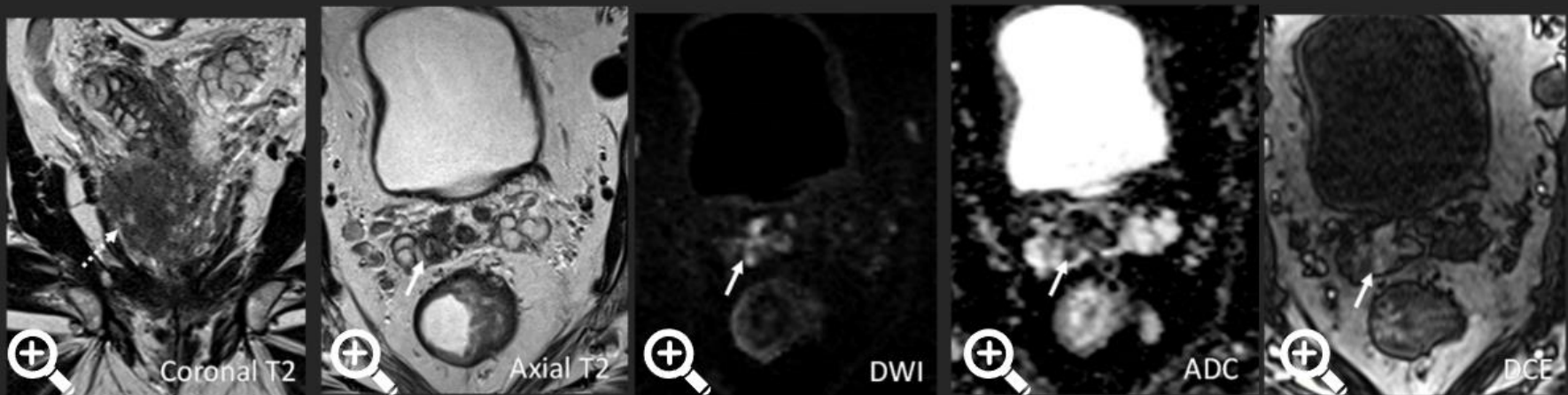
- PCa in the apex has similar mpMRI features compared to tumors in other locations, however, apical tumors are often difficult to detect and characterize due to volume averaging.
- These lesions are at risk for positive margin and recurrence after radical prostatectomy.
- Urethral invasion is considered invasive behavior (PI-RADS assessment category 5).



PI-RADS 5 lesion in the right apical region with invasion of the urethra (arrow) and EPE along the urethra seen on Coronal T2 image.

Seminal Vesicle Invasion

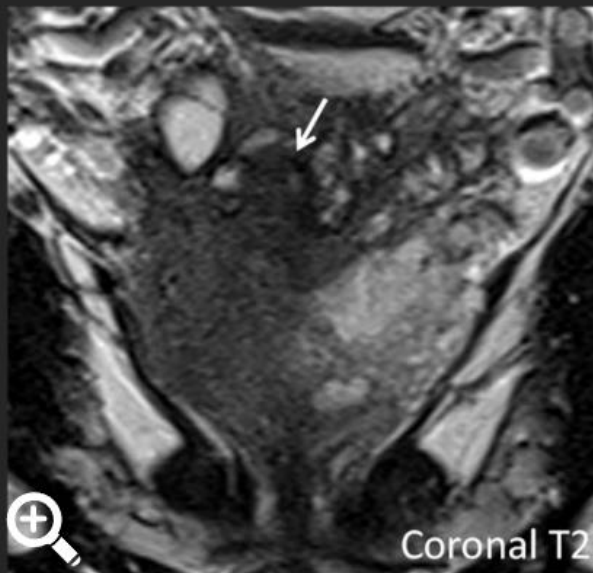
- SV invasion can result from direct growth of the tumor along the SV or from tumor extension from the base of the prostate into and around the seminal vesicle.



PI-RADS 5 lesion centered in the right lobe of the prostate (dotted arrow) with direct growth of the tumor along the right SV (solid arrow). Note corresponding restricted diffusion on DWI/ADC and enhancement on DCE.

Seminal Vesicle Invasion

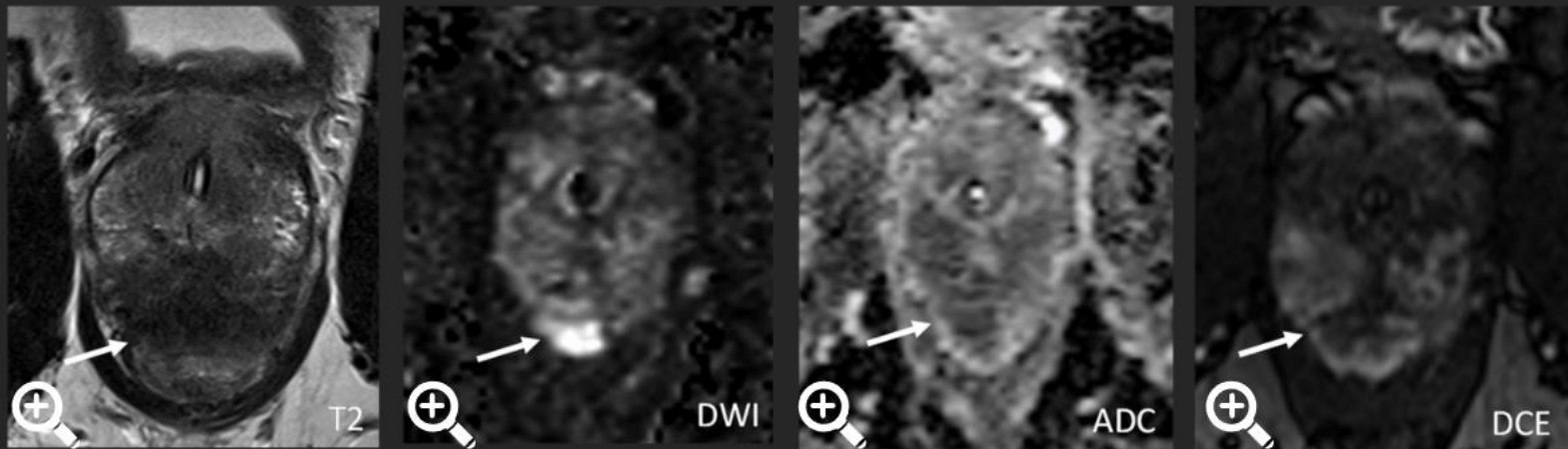
- SV invasion can result from direct growth of the tumor along the SV or from tumor extension from the base of the prostate into and around the seminal vesicle.



PI-RADS 5 lesion with extension from the base of the prostate into and around the seminal vesicle (arrow).

Bladder and Rectal Invasion

- Assessment of rectal and bladder wall invasion is important as it can help determine if tumor can be resected with negative margins.



PI-RADS 5 lesion involving the PZ with EPE and rectal wall invasion (arrow)

Bladder and Rectal Invasion

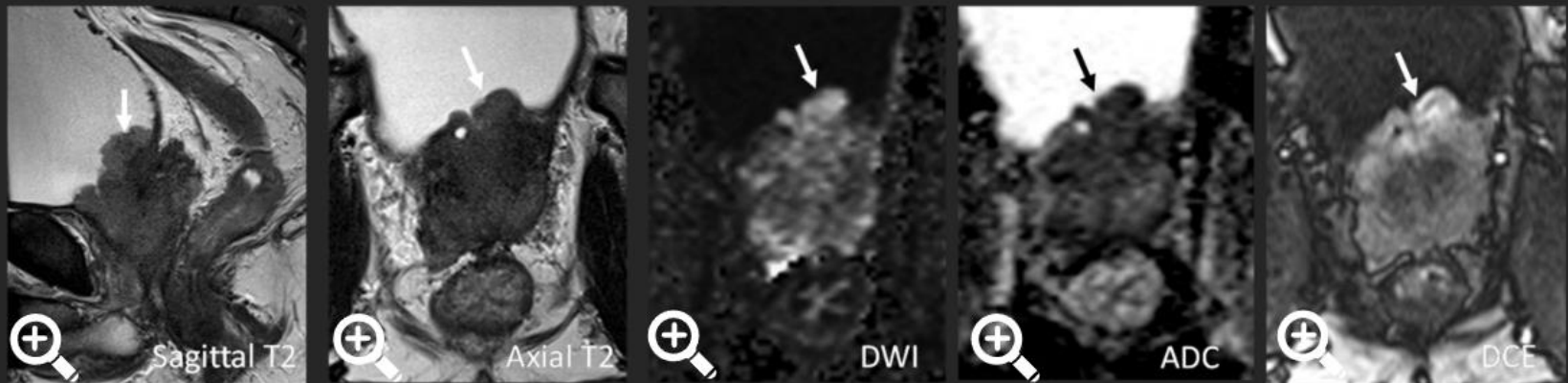
- Assessment of rectal or bladder wall invasion is important as it can help determine if tumor can be resected with negative margins.



PI-RADS 5 lesion extending into the bladder trigone.

Bladder and Rectal Invasion

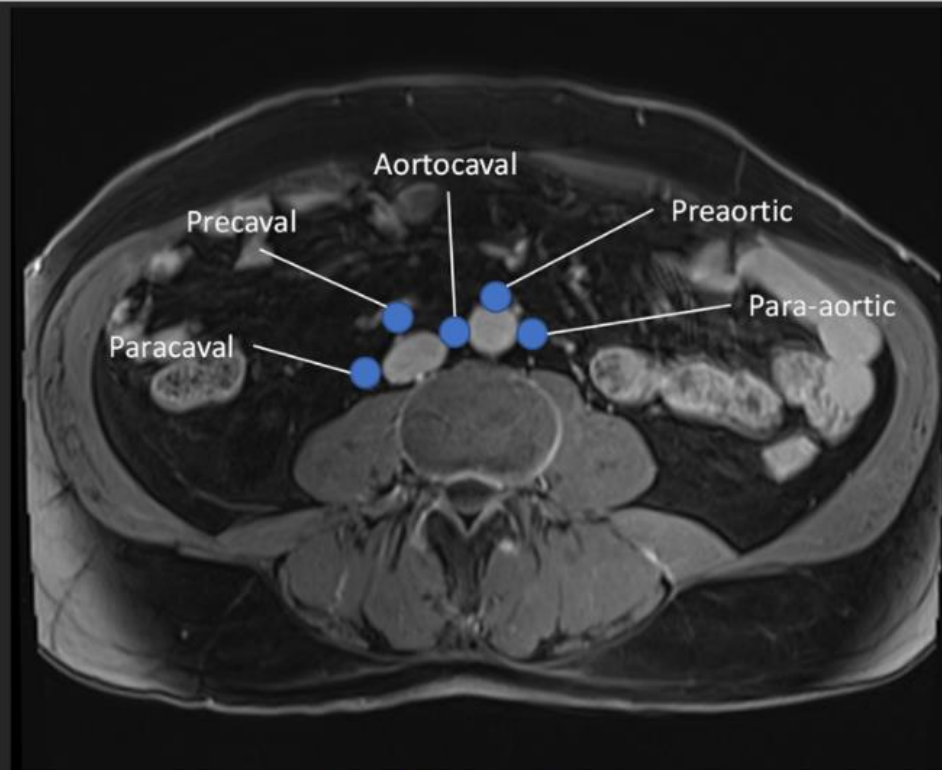
- Assessment of rectal or bladder wall invasion is important as it can help determine if tumor can be resected with negative margins.



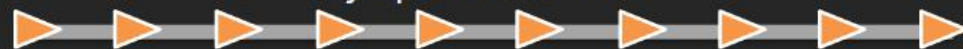
PI-RADS 5 lesion involving the prostate diffusely with extension into the bladder and SV.

Lymph Nodes

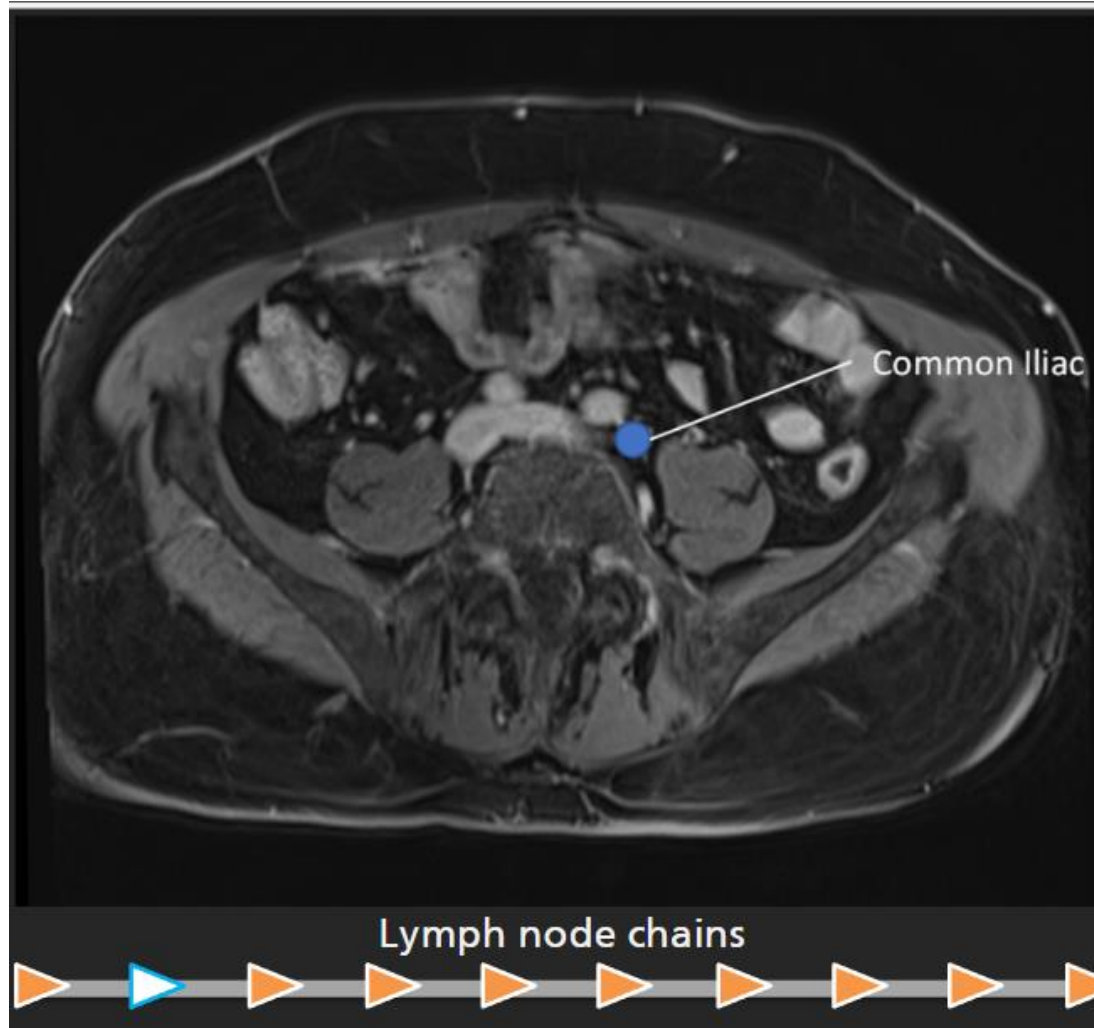
- The detection of abnormal lymph nodes on MRI is currently limited to size, morphology and shape, and enhancement pattern.
- Lymph nodes ≥ 8 mm in short axis dimension are considered suspicious.

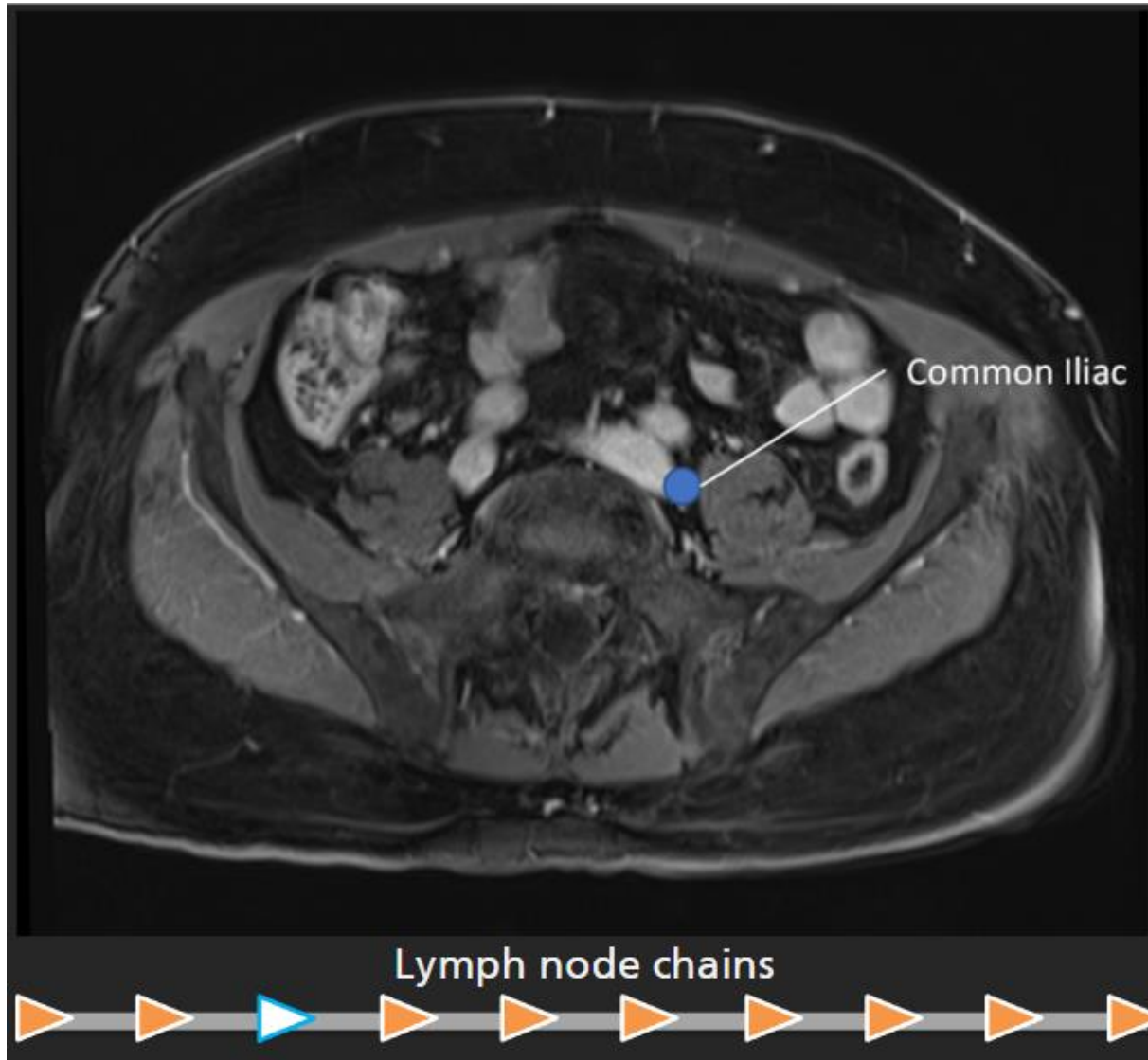


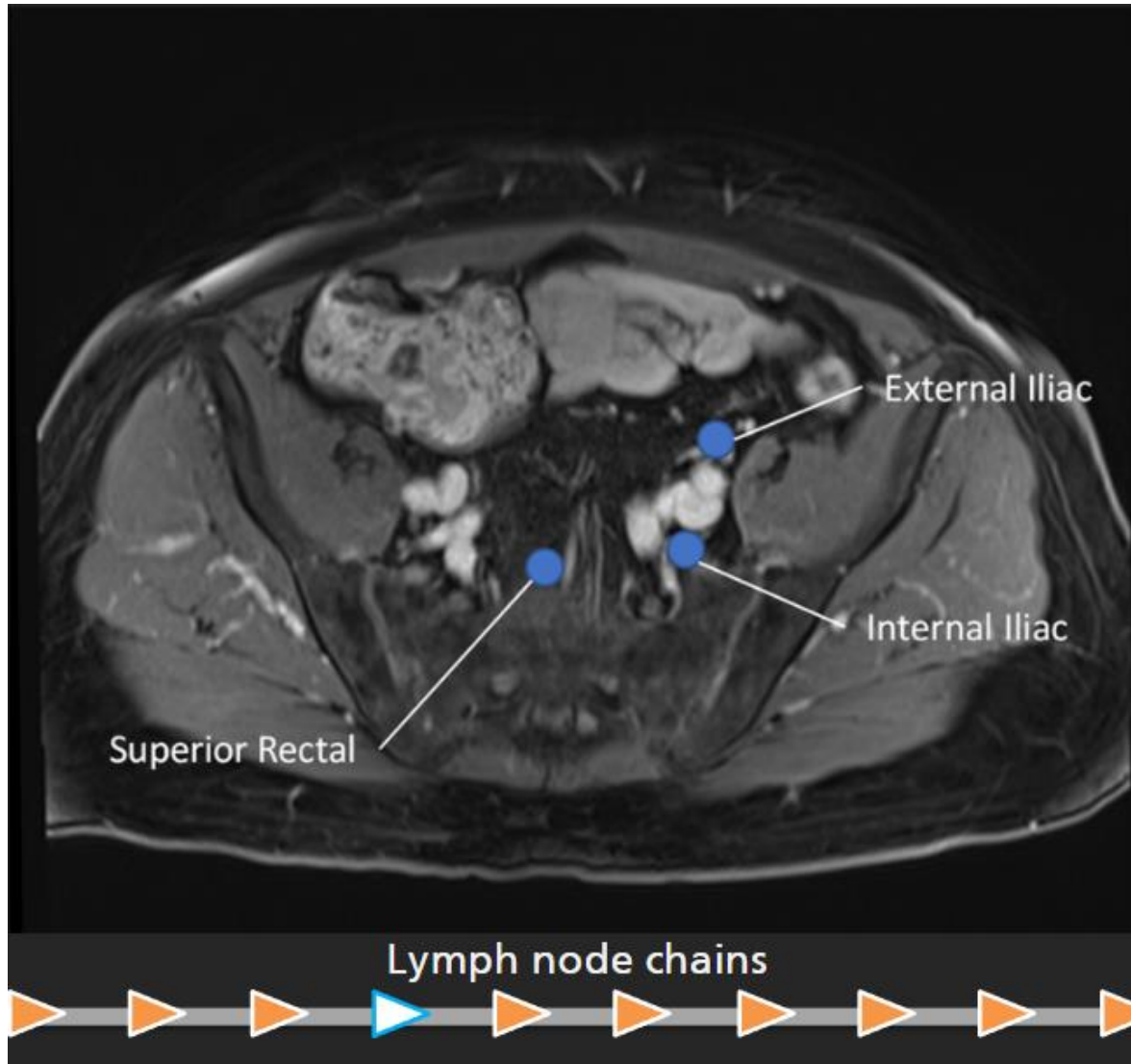
Lymph node chains

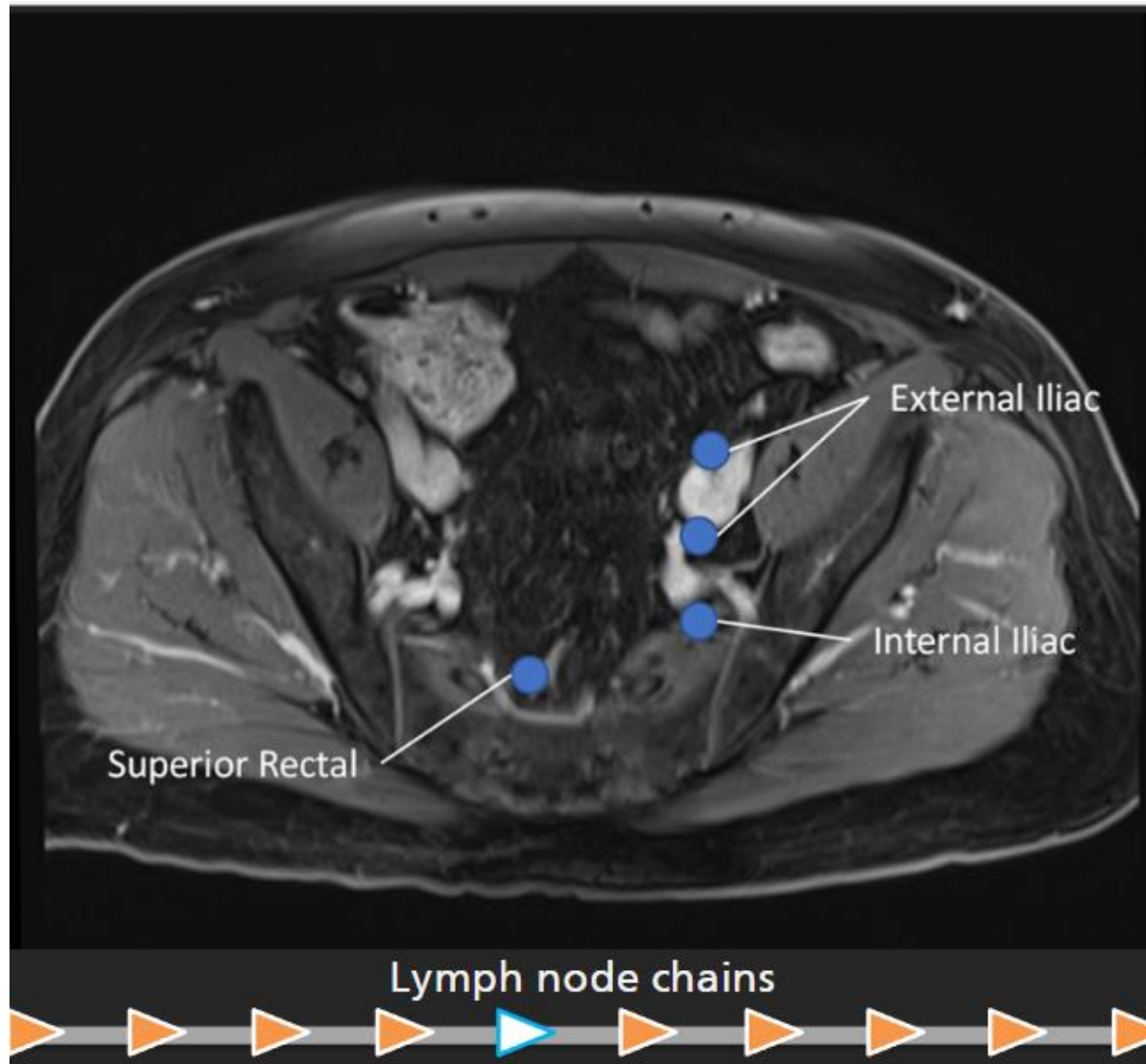


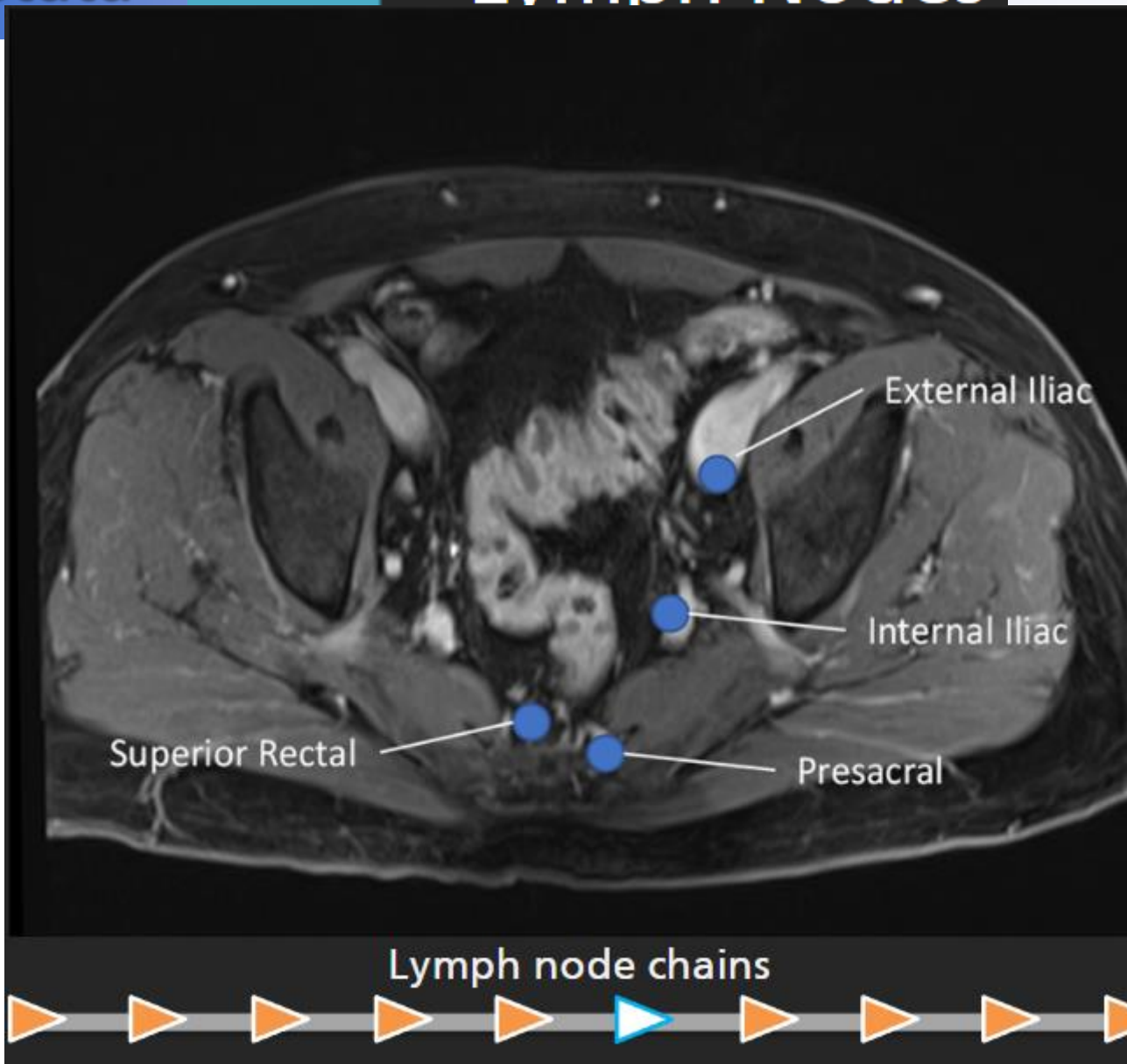
Hover over each arrow for additional views.

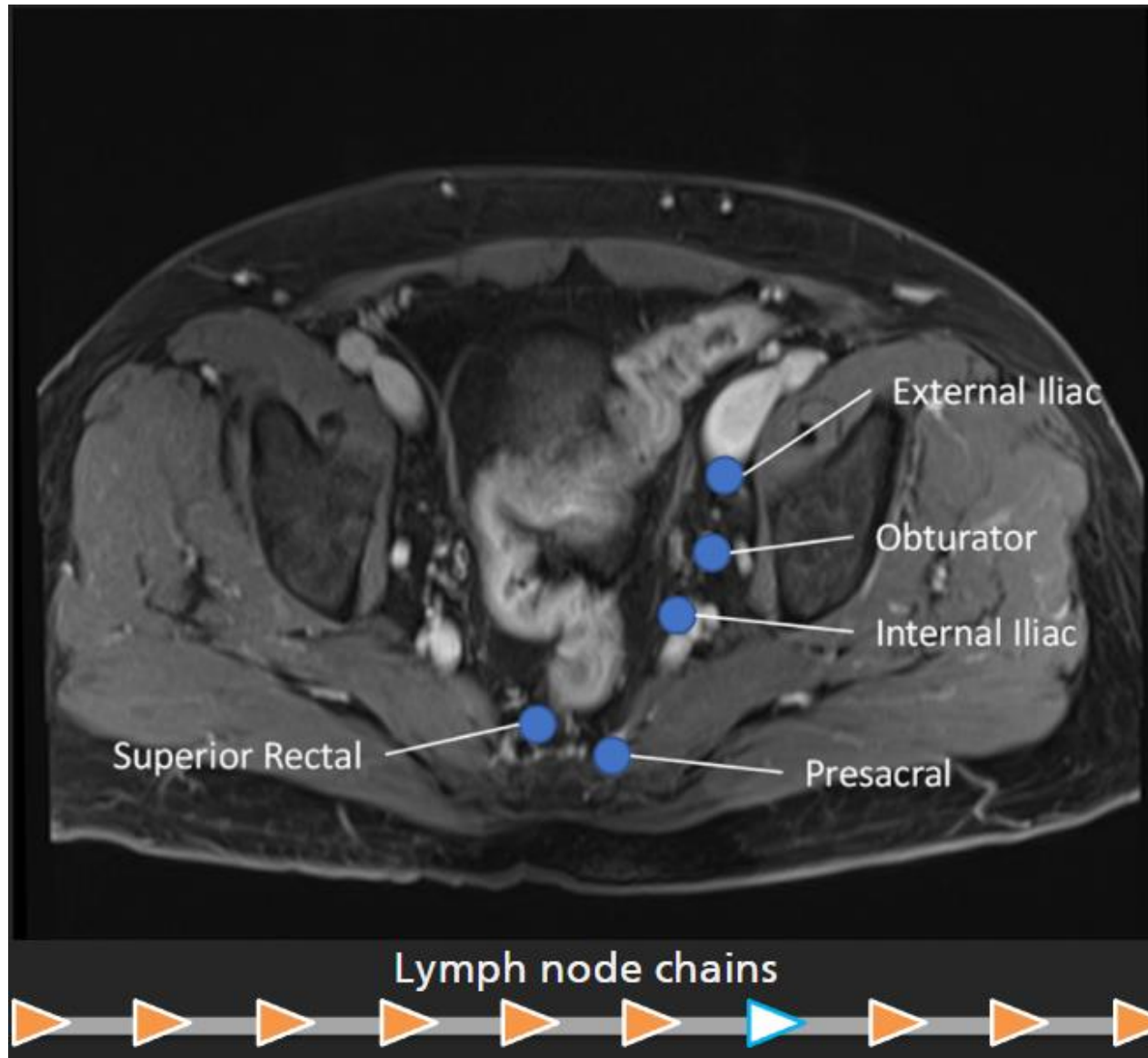


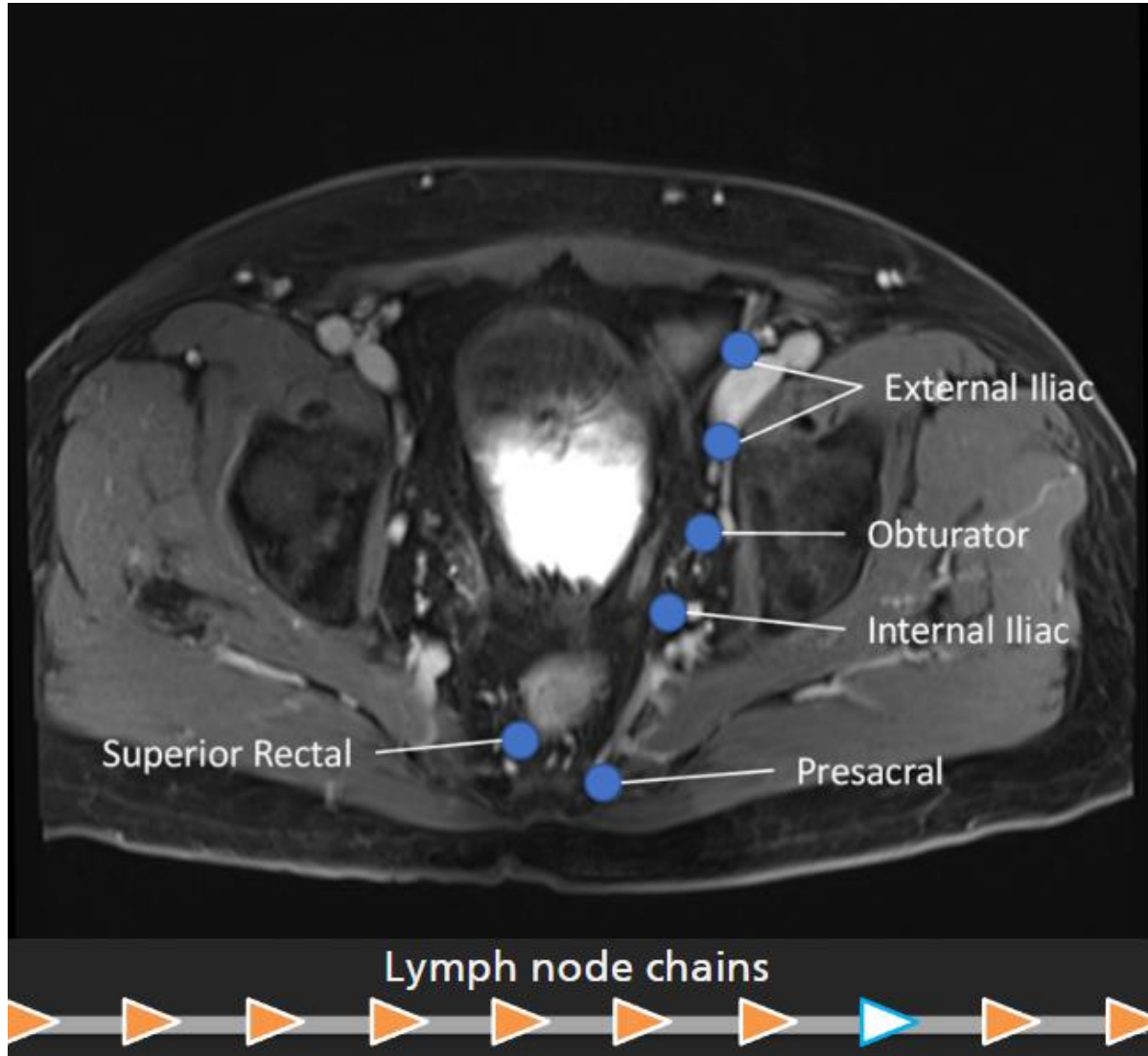


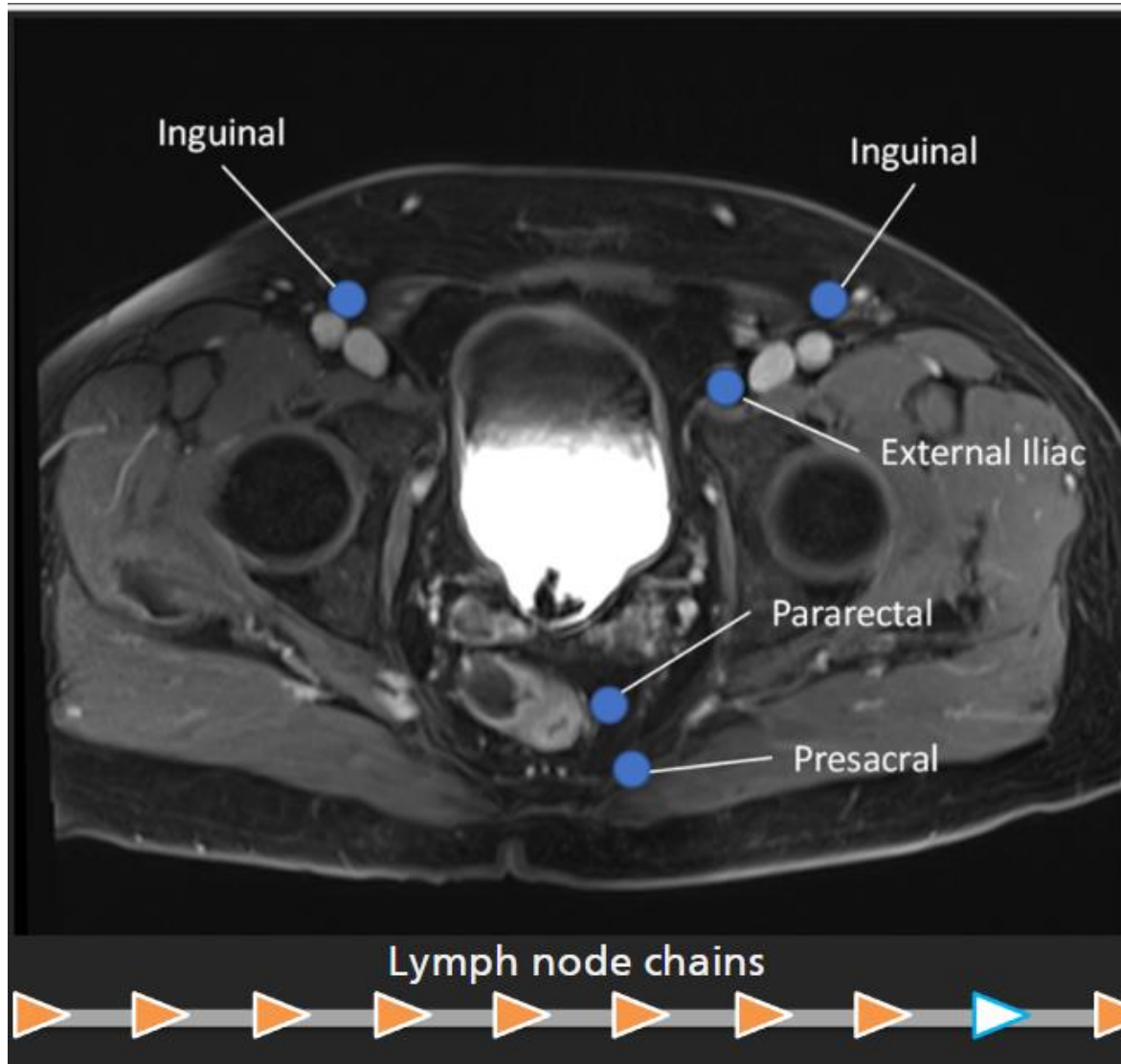


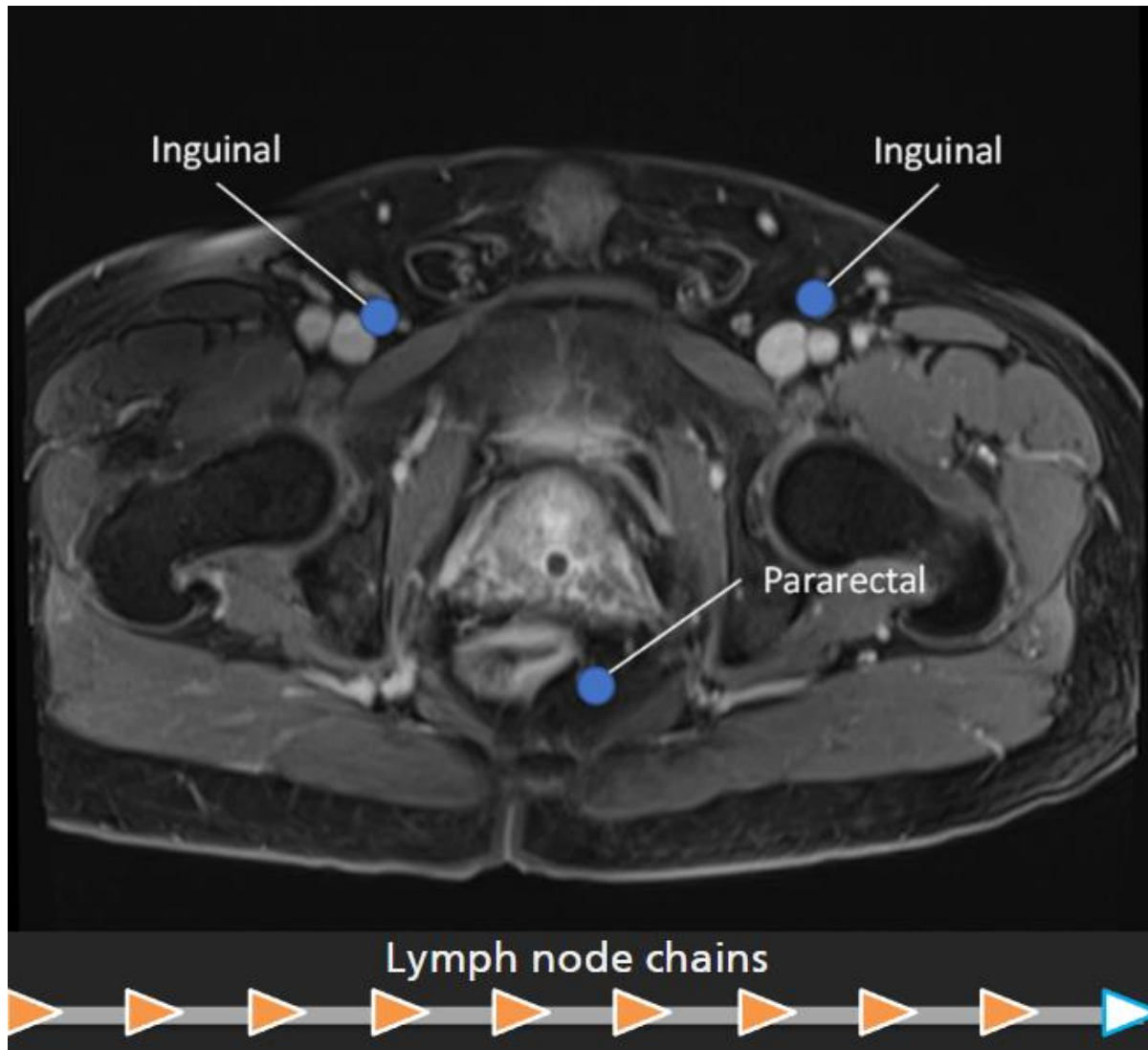




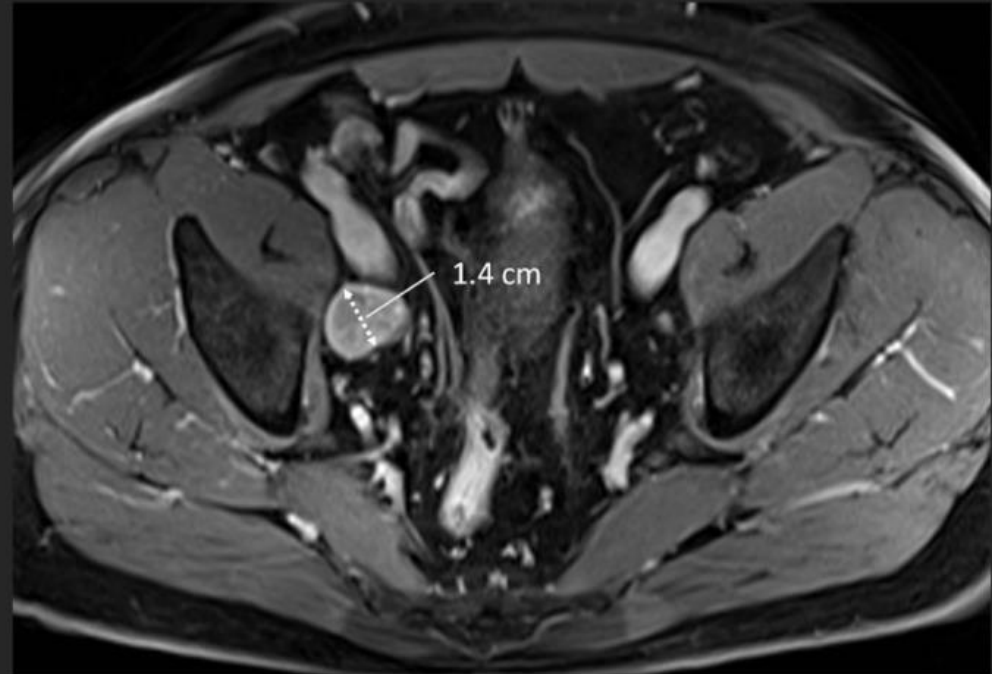








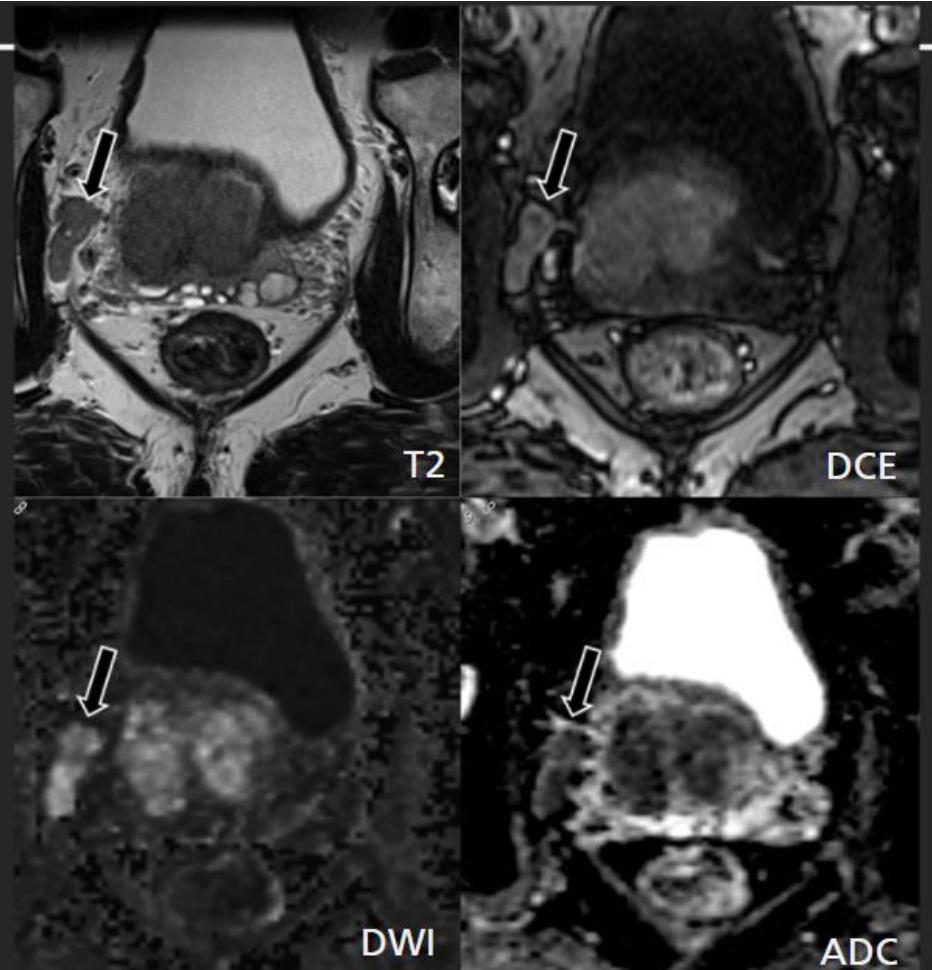
- The detection of abnormal lymph nodes on MRI is currently limited to size, morphology and shape, and enhancement pattern.
- Lymph nodes $\geq 8\text{mm}$ in short axis dimension are considered suspicious.



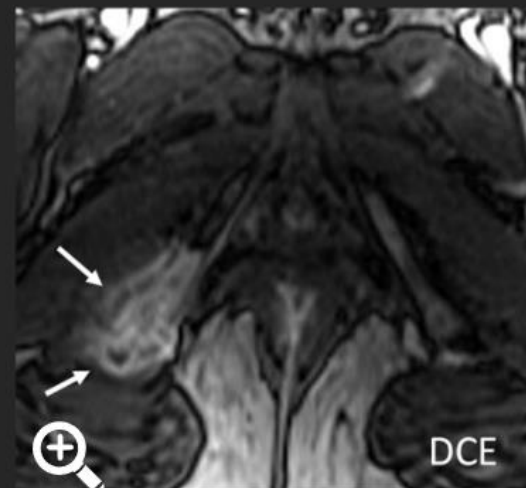
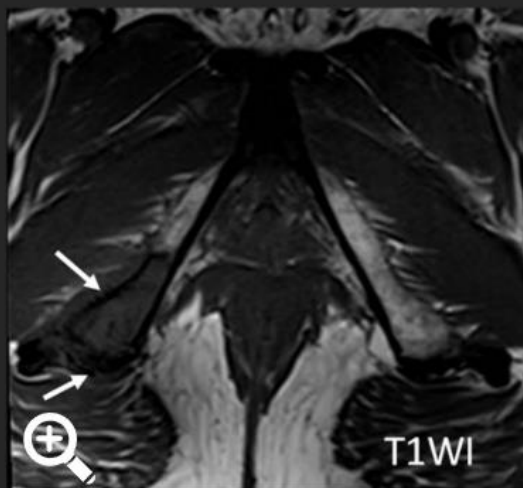
Metastatic right obturator node

- The detection of abnormal lymph nodes on MRI is currently limited to size, morphology and shape, and enhancement pattern.
- Lymph nodes ≥ 8 mm in short axis dimension are considered suspicious.

Metastatic right obturator node with irregular borders and intense enhancement.

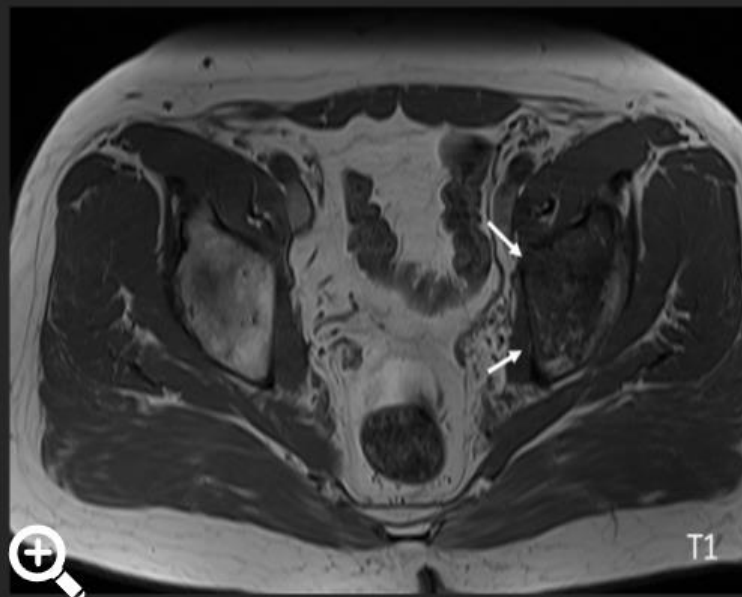


- Bony pelvis should be carefully inspected for metastases.
- T1-weighted images (T1-WI) may be useful for detection of skeletal metastases.



T1WI shows a metastatic lesion with hypointense signal in the right inferior ischiopubic ramus. The lesion has early and intense enhancement on DCE.

- Bony pelvis should be carefully inspected for metastases.
- T1-weighted images (T1-WI) may be useful for detection of skeletal metastases.



Large field of view T1WI shows a metastatic lesion with hypointense signal in the left acetabulum.

Staging

Knowledge Check

Drag the T stages to the images with abnormalities that best match the tumor T stage.

T1

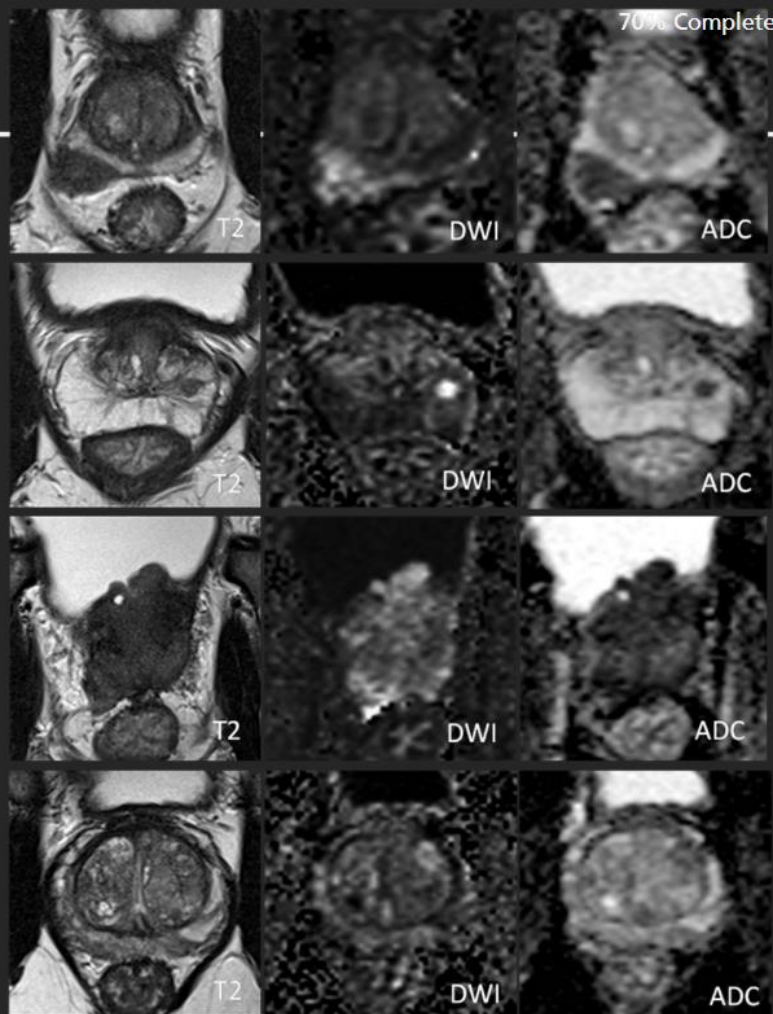
T2

T3

T4

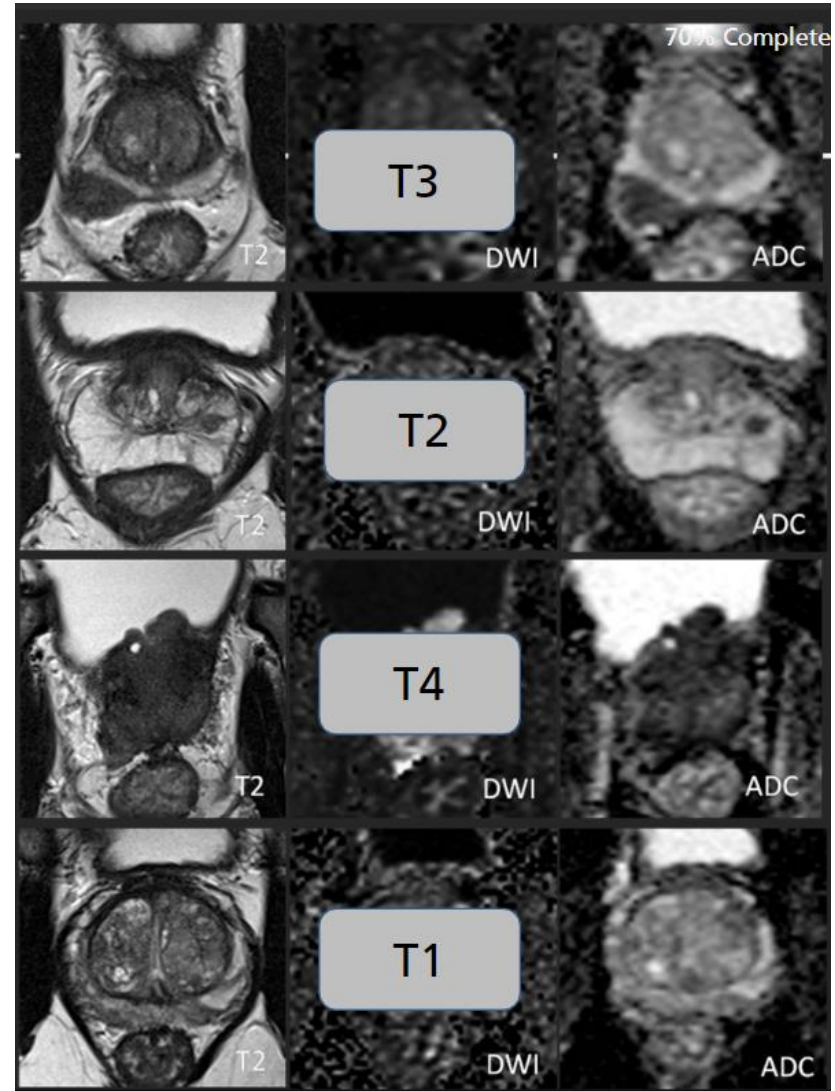
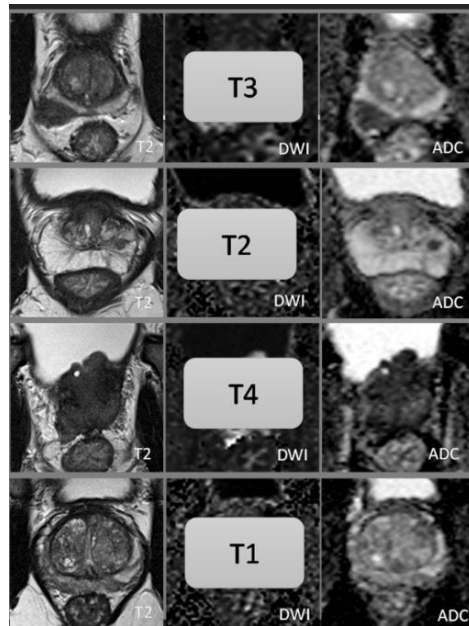
Submit

Question 1 of 5



Correct

Correct! The correct answer is T3, T2, T4, and T1



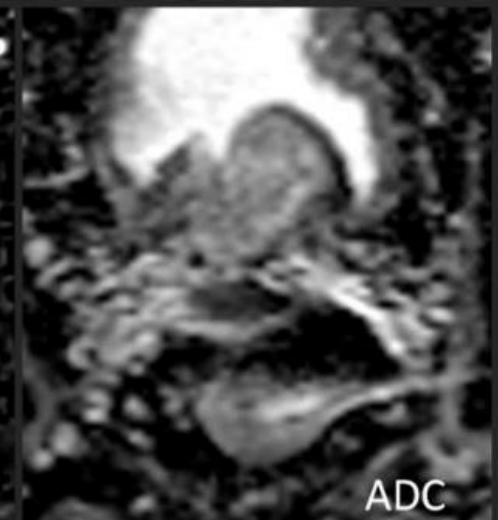
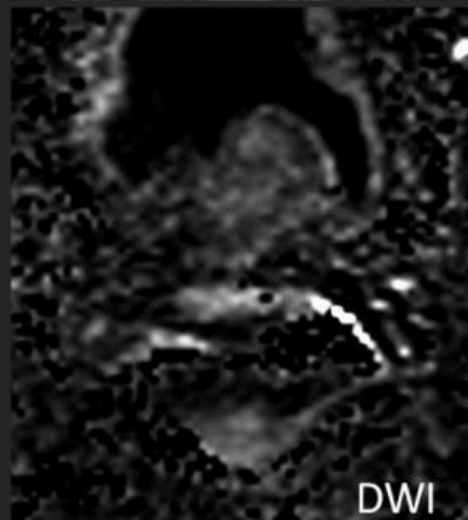
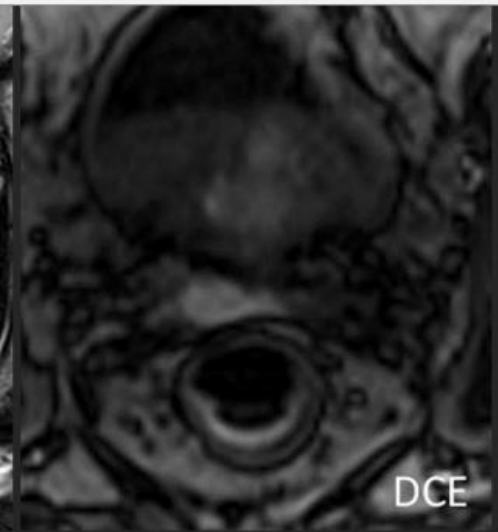
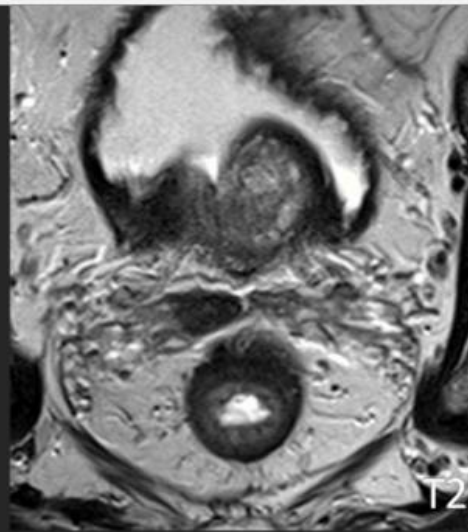
What structure is being involved by prostate cancer?

A. Neurovascular bundle

B. Seminal Vesicle

C. Bladder

D. Rectum



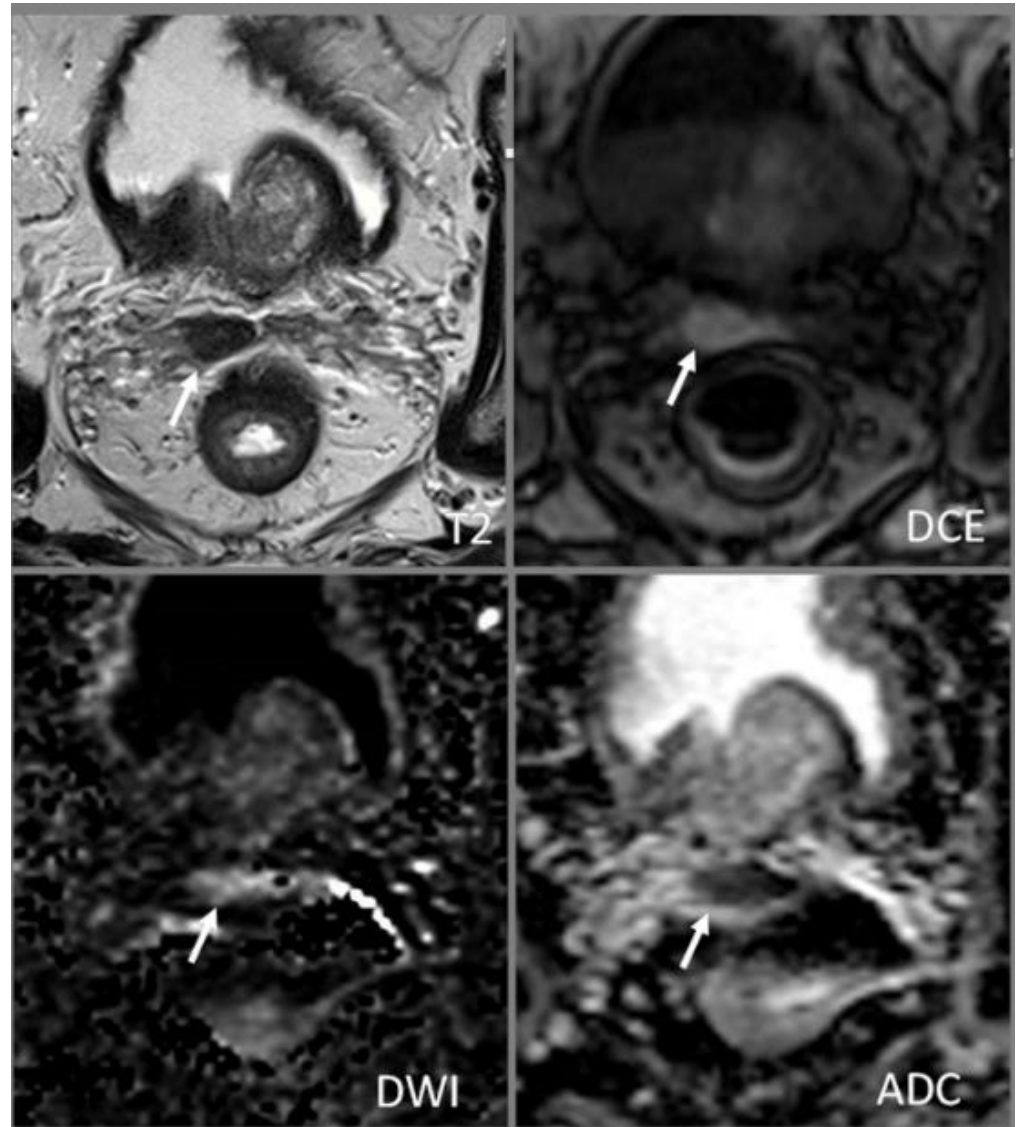
Question 2 of 5

Submit

B. Seminal Vesicle

Correct

Correct! The correct answer is
b: seminal vesicle



What is the T stage of this tumor?

A. T1

B. T2

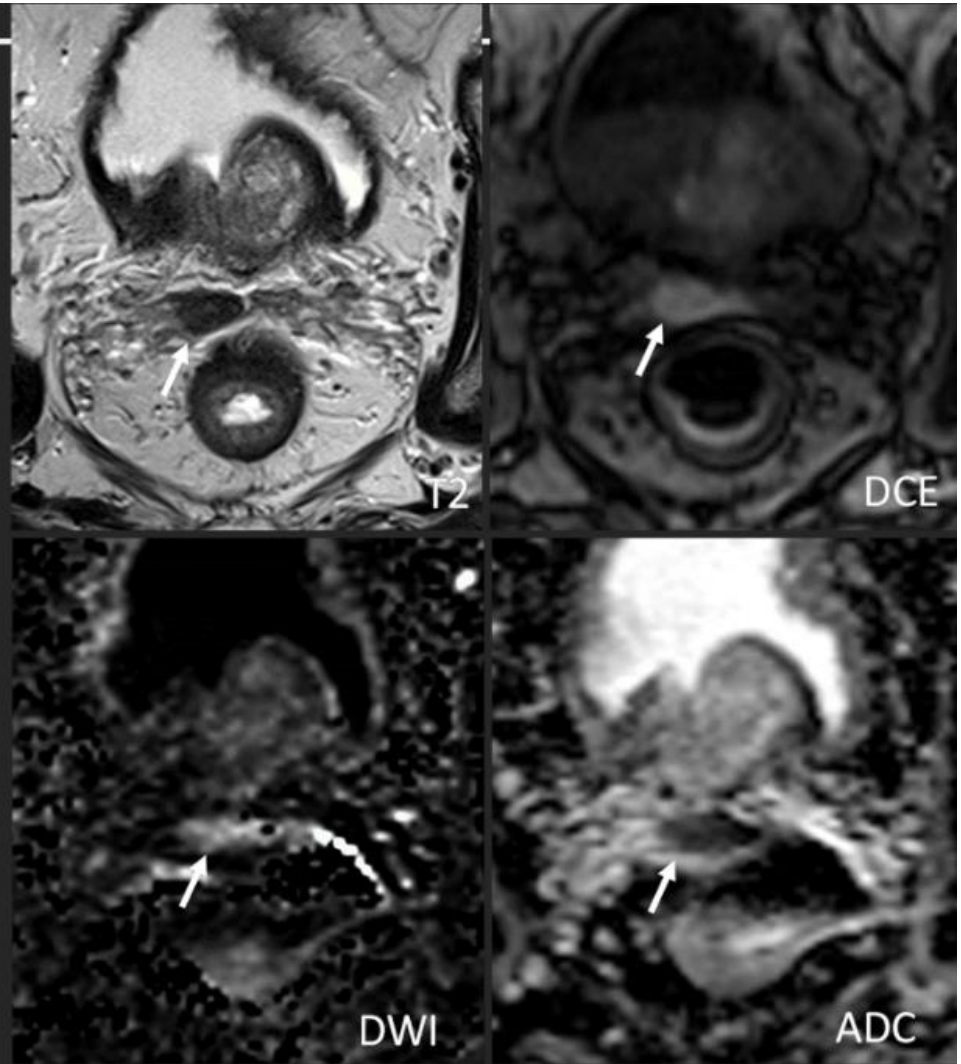
C. T3a

D. T3b

E. T4

Submit

Question 3 of 5



Correct

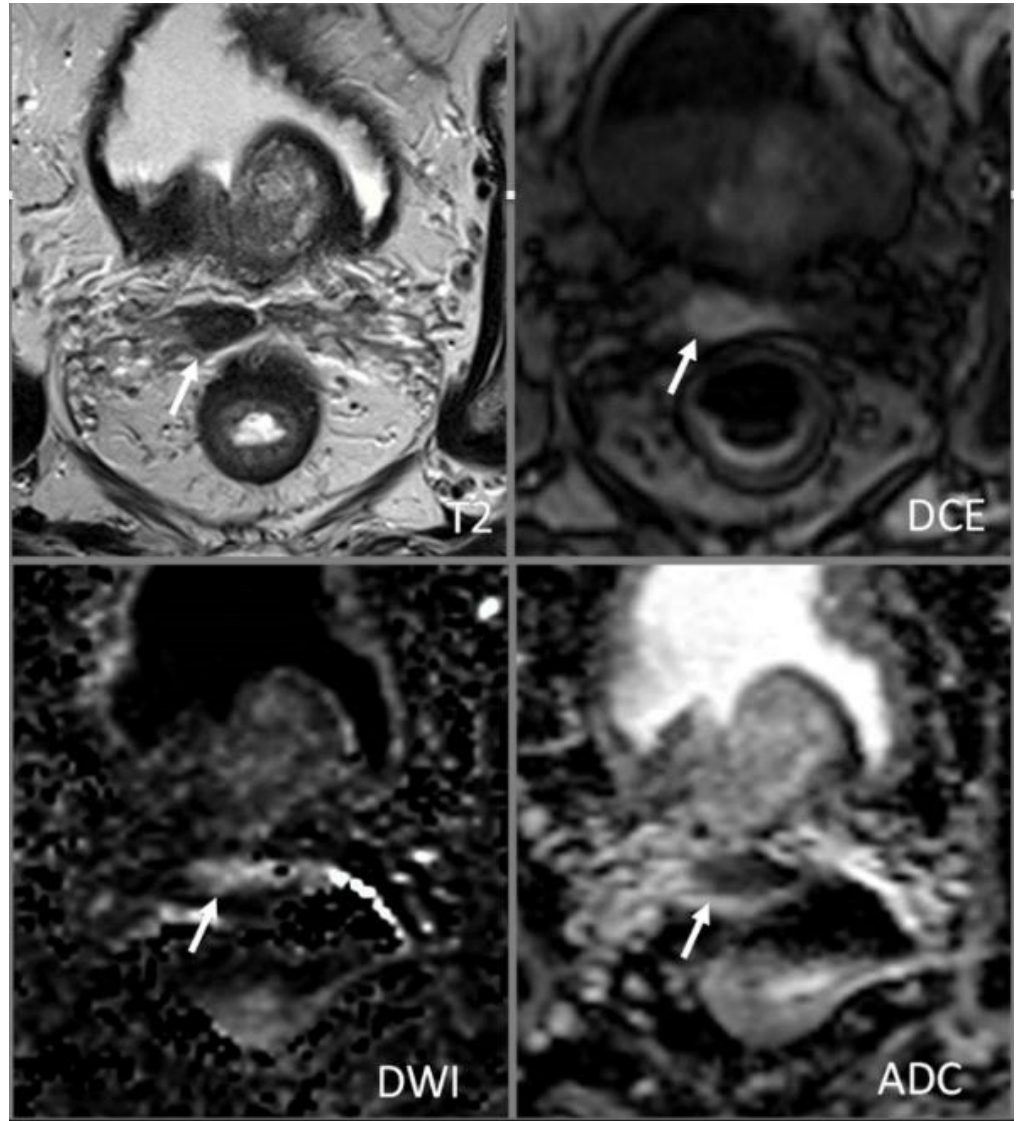
D. T3b

Correct! The correct answer is
d: T3b

T3: The tumor extends outside the prostate.

T3a: The tumor does not invade the seminal vesicles.

T3b: The tumor invades the seminal vesicles.



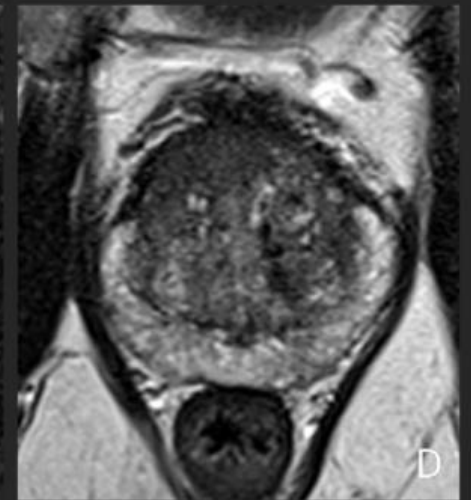
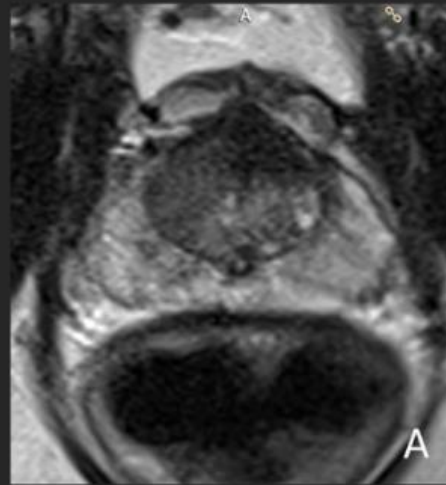
Which of the following tumors in the TZ is more likely to have extra-prostatic extension?

A. A

B. B

C. C

D. D



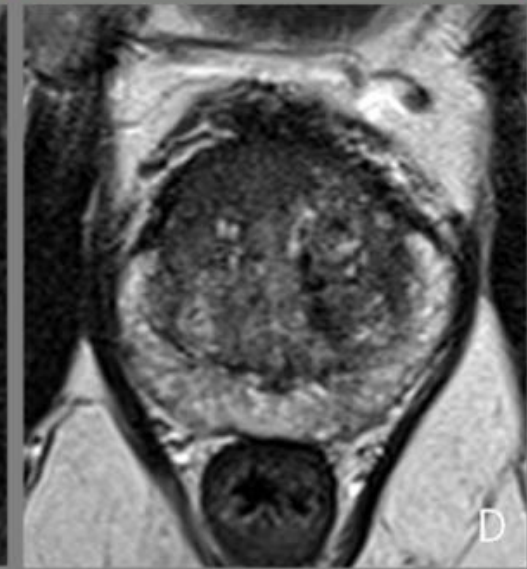
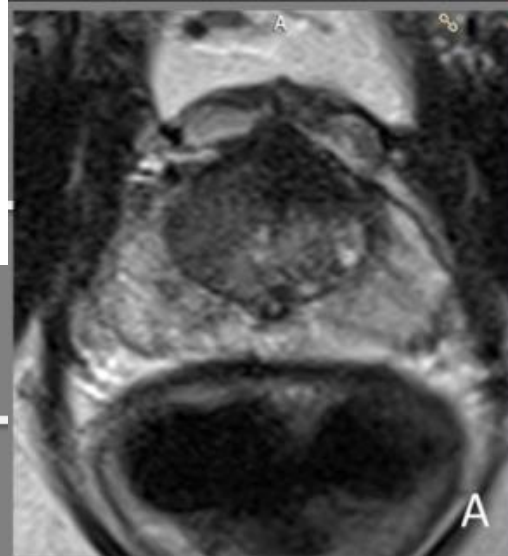
Question 4 of 5

Submit

Correct

B. B

Correct! The correct answer is b. In B the tumor extends beyond the anterior fibromuscular stroma (AFS). In the other examples, the tumors do not extend beyond the AFS.



What lymph node dimension is considered suspicious for metastatic according to PI-RADS?

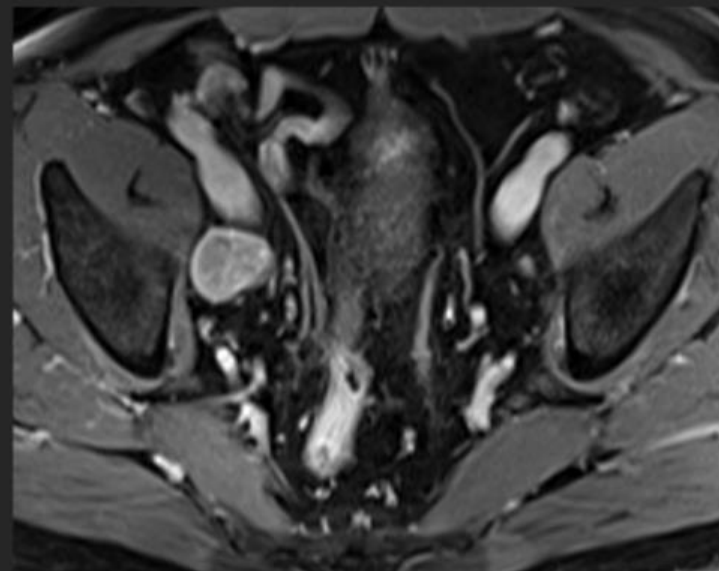
A. ≥ 1 cm in short axis

B. ≥ 1 cm in long axis

C. ≥ 1 cm in any dimension

D. ≥ 0.8 cm in short axis

E. ≥ 0.8 cm in any dimension



Question 5 of 5

Submit

RM Prostata

PI-RADS v2.1 provides a report template in order to facilitate communication between providers. The template has 5 sections:

1. Indication

Click on each tab for more details.

2. Technique

3. Comparison

4. Findings

5. Impression

1. Indication

2. Technique

3. Comparison

4. Findings

5. Impression

- Describe the indication for study: elevated PSA (initial detection of prostate cancer), active surveillance, staging or evaluation of recurrence.
- Include value of serum prostate specific antigen (PSA).
- Prior biopsy date, results and type: Systematic transrectal ultrasound (TRUS) biopsy, MRI/US fusion biopsy (e.g. software assisted or cognitive) or in-bore biopsy.
- Include information from prior therapy for prostate cancer (e.g. radiation, ablation and androgen deprivation therapy) or BPH (e.g. transurethral resection of the prostate, prostatic urethral lift, and 5-alpha reductase inhibitors).

Example:

65-year-old patient with elevated PSA and a prior negative biopsy.
PSA: 7.9 ng/mL (01/12/2021)
Prior biopsy: negative systematic TRUS biopsy on 1/20/2021
Prior treatments: None

1. Indication

2. Technique

3. Comparison

4. Findings

5. Impression

- State if the study is PI-RADS-compliant and describe the following information:
 - Magnetic field strength
 - Coils used: E.g., pelvic phased array coil, endorectal coil
 - Route and rate of IV contrast administration
 - Pulse sequence parameters (optional)

Examples 1 2

Multiplanar, multisequence imaging of the pelvis in accordance with PI-RADS recommendations before and after intravenous administration of 10 ml gadobutrol in the left antecubital fossa at 2.0 ml/sec on a 3.0 T platform using a 16-channel external phased array coil. Dedicated three-plane 20 cm FOV FSE T2; axial diffusion weighted imaging with b-values 50, 400, and 800 s/mm² and calculated b=1400 s/mm² and ADC map; and axial 3D dynamic contrast-enhanced T1-weighted imaging with 10 sec temporal resolution were acquired using 3 mm slice thickness in addition to full-pelvis post-contrast T1-weighted imaging.

If post-processing performed on a separate workstation, add:
Additional post-processing of MRI data was performed on a separate workstation [name], to include volumetric segmentation of the prostate and region of interest [ROI].

1. Indication

2. Technique

3. Comparison

4. Findings

5. Impression

- State if the study is PI-RADS-compliant and describe the following information:
 - Magnetic field strength
 - Coils used: E.g., pelvic phased array coil, endorectal coil
 - Route and rate of IV contrast administration
 - Pulse sequence parameters (optional)

Examples 1 2

Scanner: 3T [or 1.5T]

Coil: External phased array coil [and endorectal coil]

Multiplanar, multisequence imaging of the prostate in accordance with PI-RADS recommendations before and after intravenous administration of contrast. Dedicated three [or two] -plane small FOV prostate T2 images; axial diffusion weighted imaging and ADC map; and axial 3D dynamic contrast-enhanced T1-weighted imaging. Full-pelvis post-contrast T1-weighted imaging.

- If available, state the dates of prior studies.

1. Indication

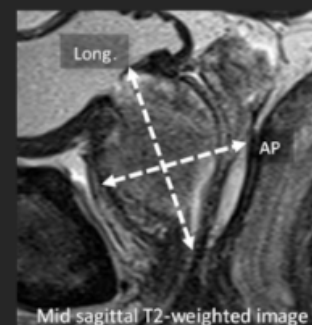
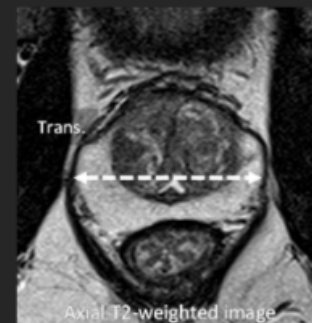
2. Technique

3. Comparison

4. Findings

5. Impression

- Prostate gland size (cm) and volume (cc or ml)
 - The max. transverse diameter of the prostate is measured in the axial T2-weighted image; the longitudinal and anteroposterior (AP) diameters are measured in the mid sagittal plane.
 - Volume can be calculated based on ellipsoid formula:
 - $\text{max. antero-posterior dimension} \times \text{max. longitudinal dimension} \times \text{max. transverse dimension} \times 0.52$
 - Alternatively, it may be determined using manual or automated gland segmentation
 - Prostate volume can be used to calculate PSA density
 - $\text{PSAD} = \text{serum PSA} / \text{prostate volume}$ (reported in ng/ml^2)
 - The probability of clinically significant cancer increases with increasing PSAD levels.



1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Indicate the presence of artifacts and their impact on imaging interpretation.
- Alternative, rate image quality as diagnostic, suboptimal or non-diagnostic. When appropriate, indicate the reason for suboptimal or non-diagnostic rating.

Example

"Mild geometric distortion on diffusion-weighted imaging from rectal distention does not compromise diagnostic confidence."

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

➤ Indicate the presence or absence of residual post-biopsy hemorrhage.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Indicate the presence of signal alterations presumably from benign conditions and whether focal findings are present or not.

Example

Peripheral zone: Slightly heterogeneous low signal. Focal findings as below.

Transition zone: Moderate heterogeneity consistent with prostatic hyperplasia. No focal findings.

Click on items below for more information.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

Describe in rank order of severity starting with the Index lesion.

Index lesion: The lesion that receives the highest PI-RADS assessment category. If the highest PI-RADS Assessment Category is assigned to two or more lesions, the index lesion should be the one that shows EPE. If none of the lesions demonstrate EPE, the largest of the tumors with the highest PI-RADS Assessment Category should be considered the index lesion.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

Largest diameter measured in the **dominant pulse sequence** for the zone where the lesion is located:
- PZ lesions: **ADC map**
- TZ lesions: **T2W**

If lesion measurement is difficult or compromised in the dominant sequence, measurement should be made on the sequence that shows the lesion best.

The minimum requirement is to report the largest dimension of a lesion on an axial image. If the largest dimension of a lesion is on sagittal and/or coronal images, this measurement and imaging plane should also be reported. If a lesion is not clearly delineated on an axial image, report the measurement on the image which best depicts the finding.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

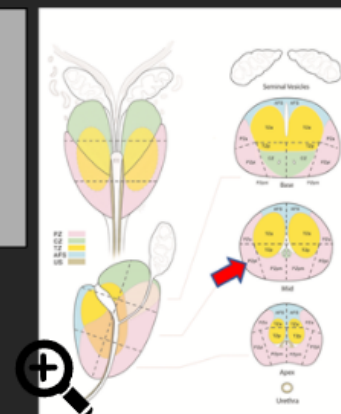
Extra-prostatic Findings

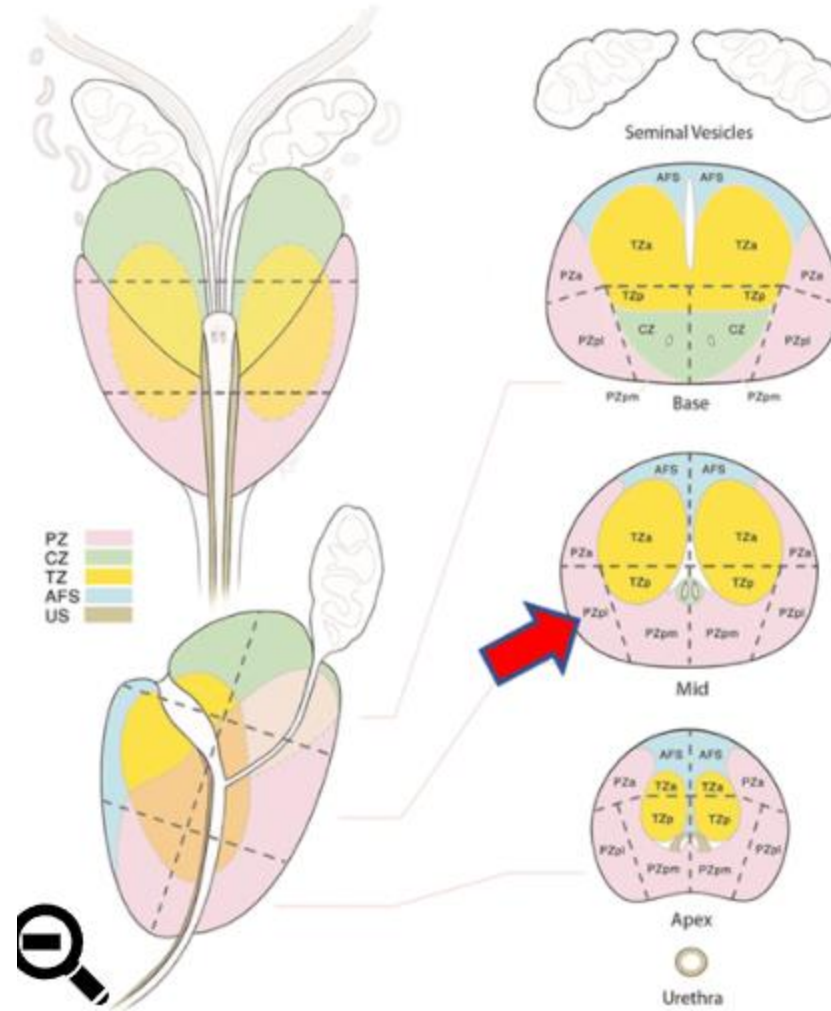
- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

Use PI-RADS sector map and image series/number. If a suspicious finding extends beyond the boundaries of one sector, all neighboring involved sectors should be indicated on the sector map (as a single lesion).

Example

Lesion #1:
- Side: right
- Level: midgland
- Zone: peripheral zone
- Diagram - sector: PZpl
- Image series/number





1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

Information from individual sequences is considered optional but may be helpful when determining the overall suspicion category.

1 2

Assessment categories for this lesion:

- T2 = 3/5
- DWI-ADC = 3/5
- DCE = (-)
- Overall PI-RADS for this lesion = 3/5

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

Information from individual sequences is considered optional but may be helpful when determining the overall suspicion category.

1 2

Expanded assessment categories with descriptors:
T2: circumscribed, homogeneous, moderately hypointense (score 4/5)
DWI: focal mildly hyperintense on high b-value DWI and moderately hypointense on ADC (score 3/5)
DCE: focal early enhancement (positive)
Extra-prostatic extension: absent
Lesion overall PI-RADS category: 4/5

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- **Extra-prostatic extension**
- Lesion overall PI-RADS category

Indicate if extra-prostatic extension (EPE) is absent, indeterminate or definite present.

Please note that PI-RADS v2.1 does not adopt a specific method for grading the probability of EPE. However, clinicians typically inquire about the risk of EPE based on imaging.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Lesion number
- Lesion size
- Location
- T2 score
- DWI score
- DCE score
- Extra-prostatic extension
- Lesion overall PI-RADS category

Assign the 1-5 overall assessment category.

It is important to keep in mind that the PI-RADS v2.1 overall suspicion category only applies when using the PI-RADS interpretation system.

Clinical parameters should not be used to influence or modify the assessment of focal lesions when assigning the overall PI-RADS category of a lesion.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Neurovascular bundle
- Seminal vesicle
- Lymph nodes
- Bones
- Other pelvic organs

Indicate if neurovascular bundle (NVB) invasion is absent, indeterminate or present.

If NVB invasion is indeterminate or present, indicate the side and location (i.e. apex, midgland or base).

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Neurovascular bundle
- Seminal vesicle
- Lymph nodes
- Bones
- Other pelvic organs

Indicate if seminal vesicle involvement is present, indeterminate or absent.

1. Indication	Prostate Gland size and volume	
2. Technique	Quality	
3. Comparison	Hemorrhage	➤ Neurovascular bundle
4. Findings	Peripheral and Transition Zone	➤ Seminal vesicle
5. Impression	Focal Lesion	➤ Lymph nodes
	Extra-prostatic Findings	➤ Bones
		➤ Other pelvic organs

Indicate if enlarged lymph nodes are present or absent. If present, indicate their location.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Neurovascular bundle
- Seminal vesicle
- Lymph nodes
- **Bones**
- Other pelvic organs

Indicate whether bone lesions are present or not.

1. Indication

Prostate Gland size and volume

2. Technique

Quality

3. Comparison

Hemorrhage

4. Findings

Peripheral and Transition Zone

5. Impression

Focal Lesion

Extra-prostatic Findings

- Neurovascular bundle
- Seminal vesicle
- Lymph nodes
- Bones
- **Other pelvic organs**

Describe involvement of other pelvic organs.

1. Indication

2. Technique

3. Comparison

4. Findings

5. Impression

- The overall suspicion based on the highest PI-RADS score should be reported in every case.
- In this section, additional information can be provided to modulate the final impression (e.g., when a peripheral zone lesion may be high suspicion but still consistent with prostatitis in the setting of bacteriuria, urgency, dysuria, and perineal pain).
- When there are no findings with a PI-RADS assessment category >2 , the overall PI-RADS assessment category for the MRI exam should be reported as PI-RADS 1: clinically significant cancer is highly unlikely or PI-RADS 2: clinically significant cancer is unlikely depending.
- Explicit reporting of the presumed stage based on imaging is recommended, but optional.

Example

Impression:

1. Very high suspicion right transition zone lesion with extraprostatic extension, MRI stage T3a (PI-RADS 5).
2. High suspicion lesion left peripheral zone lesion without extraprostatic extension (PI-RADS 4).

Overall PI-RADS category 5

What is the estimated volume of a prostate that measures 4.3 cm (transverse), 4.5 cm (longitudinal) and 3.8 cm (antero-posterior) based on the ellipsoid formula?

A. 73.5 mL

B. 38.2 mL

C. 18.4 mL

D. 140.6 mL

Submit

Question 1 of 5

Correct

That's right! Answer: b. 38.2 mL

Explanation: the prostate volume is calculated using the ellipsoid formula by multiplying the max. transverse diameter x max. longitudinal diameter x max. antero-posterior diameter x 0.52.

The PSA density of a patient with a serum PSA of 12 ng/mL and a prostate gland volume of 38 mL is:

A. 456

B. 3.16

C. 0.31

D. 0.031

Submit

Question 2 of 5

C. 0.31

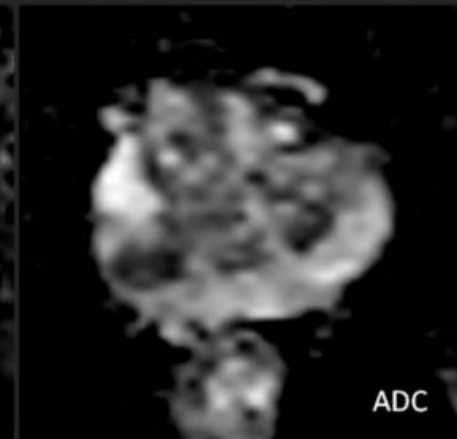
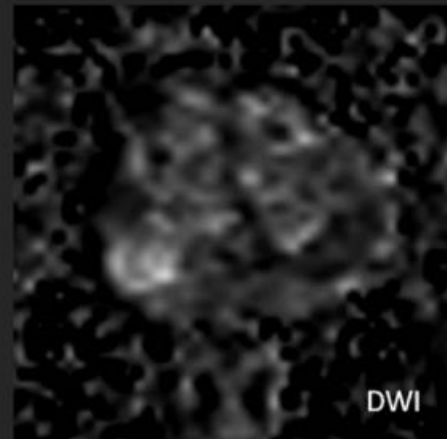
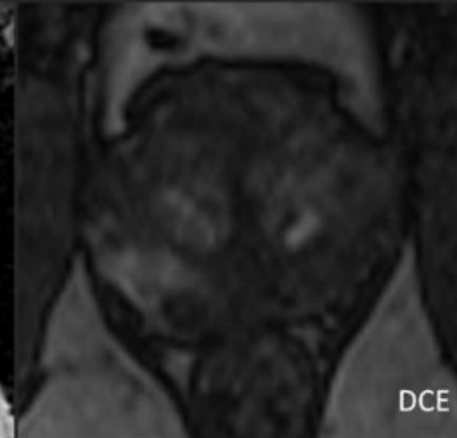
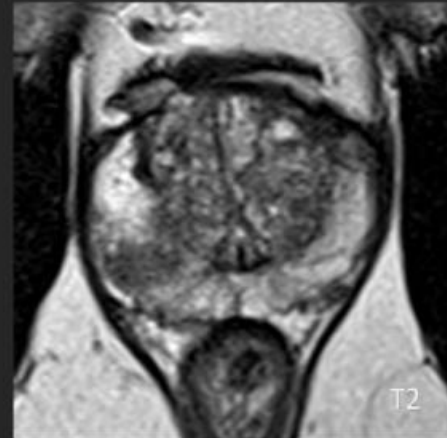
Correct

That's right! Answer: c. 0.31

Explanation: The PSA density is obtained by dividing the serum PSA by the gland volume (reported in ng/mL/mL). While a value > 0.15 confers a higher risk of prostate cancer, this value should not influence how PI-RADS assessment categories are assigned.

Which of the following is used to measure a lesion located in the peripheral zone:

- A. T2-weighted images
- B. Diffusion weighted images
- C. Apparent diffusion coefficient map
- D. Dynamic contrast enhanced T1-weighted images



Question 3 of 5

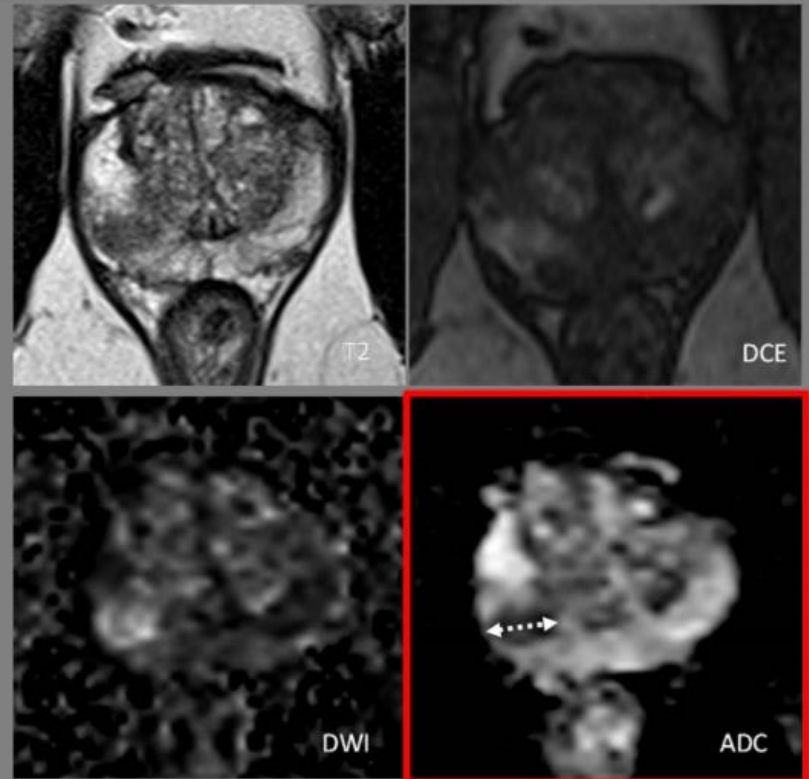
Submit

Correct

That's right! Answer: c. Apparent diffusion coefficient maps
 Explanation: In the PZ, lesions should be measured on ADC. In the TZ, lesions should be measured on T2W. If lesion measurement is difficult or compromised on ADC (for PZ) or T2W (for TZ), measurement should be made on the sequence that shows the lesion best.

Continue

C. Apparent diffusion coefficient map



Which of the following lesions would be considered the index lesion?

A. 2 cm PI-RADS 3 lesion

B. 1.7 cm PI-RADS 4 lesion

C. 1.6 cm PI-RADS 5 lesion without
extraprostatic extension

D. 1.4 cm PI-RADS 5 lesion with
extraprostatic extension

Submit

Question 4 of 5

Correct

That's right! Answer: d. PI-RADS 5 lesion with extraprostatic extension

Explanation: The index lesion is the lesion with the highest PI-RADS score. If the highest PI-RADS Assessment Category is assigned to two or more lesions, the index lesion should be the one that shows EPE. If none of the lesions demonstrates EPE, the largest of the tumors with the highest PI-RADS Assessment Category should be considered the index lesion.

D. 1.4 cm PI-RADS 5 lesion with extraprostatic extension

Which of the following is considered optional when reporting a focal lesion?

A. Lesion location

B. PI-RADS descriptors on individual pulse sequences

C. Presence or absence of extra-prostatic extension

D. Overall PI-RADS assessment category

Question 5 of 5

Submit

Correct

That's right! Answer: b. PI-RADS descriptors on individual pulse sequences

Explanation: Descriptors that define imaging characteristics of a focal lesion on individual pulse sequences (T2, DWI-ADC, DCE) may be included in the report, however are optional. The scoring of each sequence contributing to the Overall PI-RADS Assessment Category should be included.

Optional → Expanded, with descriptors:

- T2 = Homogeneous moderately hypointense focus 4/5
- DWI-ADC = Mildly hypointense on ADC and mildly hyperintense on high b-value DWI 3/5
- DCE = Focal early enhancement corresponding to DWI (+)
- Overall PI-RADS for this lesion = 4/5

Abbreviated, with scoring:

- T2 = 4/5
- DWI-ADC = 3/5
- DCE = (+)
- Overall PI-RADS for this lesion = 4/5

[Return to Menu](#)

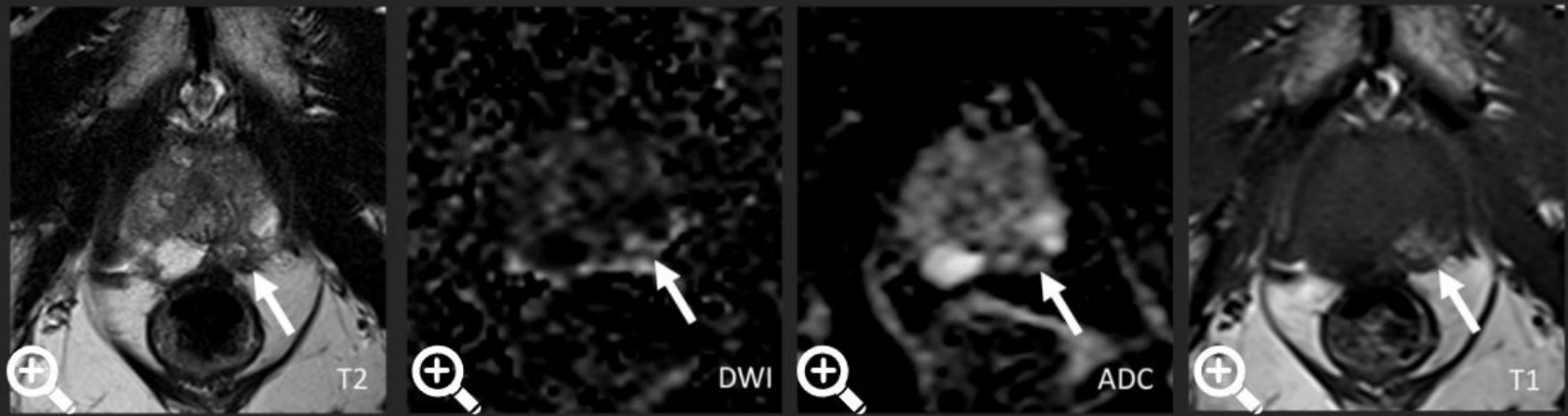
B. PI-RADS descriptors on individual pulse sequences

The following topics will be covered in this section:

- Patient preparation
- Hardware considerations
- Pulse sequences

Interval between biopsy and MRI

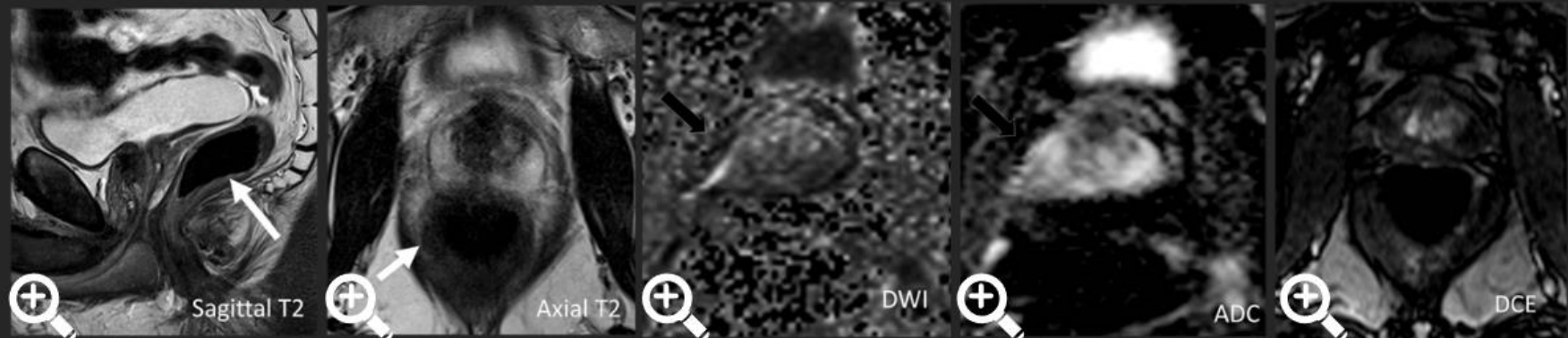
- An interval ≥ 6 weeks between biopsy and MRI should be considered to mitigate the negative impact of post biopsy changes, including hemorrhage and inflammation, in prostate MRI interpretation.



Focal lesion in the left peripheral zone at the apex (arrow) with hypointense signal on T2WI, hyperintense signal on DWI and hypointense signal on ADC map mimicking the appearance of prostate cancer. The abnormality demonstrates hyperintense signal on T1WI which is compatible with residual post-biopsy hemorrhage.

Bowel Preparation

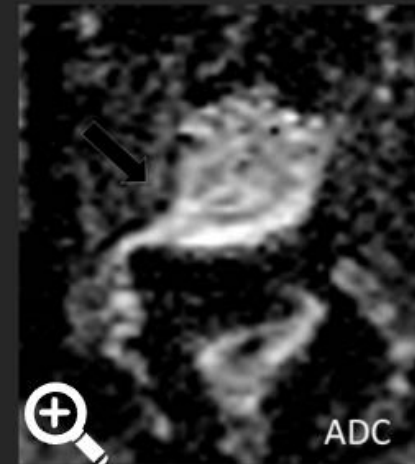
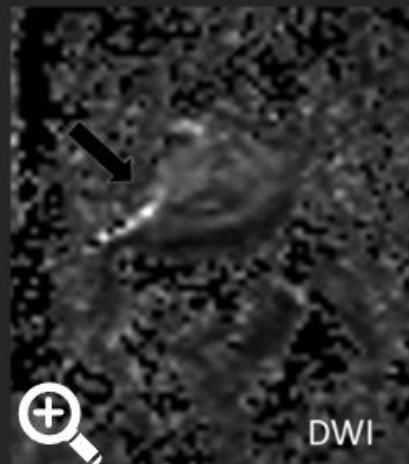
- Prior to the exam, patients should be encouraged to evacuate the rectum to minimize susceptibility artifacts on DWI caused by stool and gas.
- For some patients, the use of enema prior to the exam may help reduce artifacts related to gas and peristalsis.



Patient with large amount of stool and gas in the rectum (white arrow) resulting in susceptibility artifacts and geometric distortion on DWI and ADC map (black arrows). There is also blurring of the axial T2WI due to motion artifacts.

Bowel Preparation

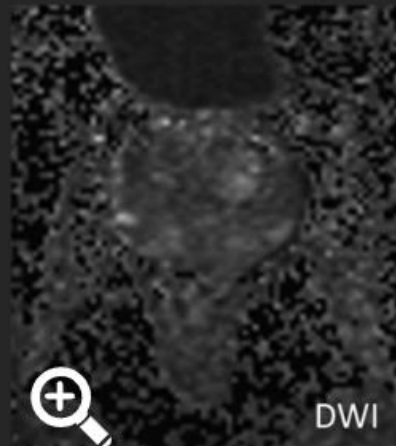
- Prior to the exam, patients should be encouraged to evacuate the rectum to minimize susceptibility artifacts on DWI caused by stool and gas.
- For some patients, the use of enema prior to the exam may help reduce artifacts related to gas and peristalsis.



Patient with large amount of stool and gas in the rectum (white arrow) resulting in susceptibility artifacts and geometric distortion on DWI and ADC map (black arrows).

Bowel Preparation

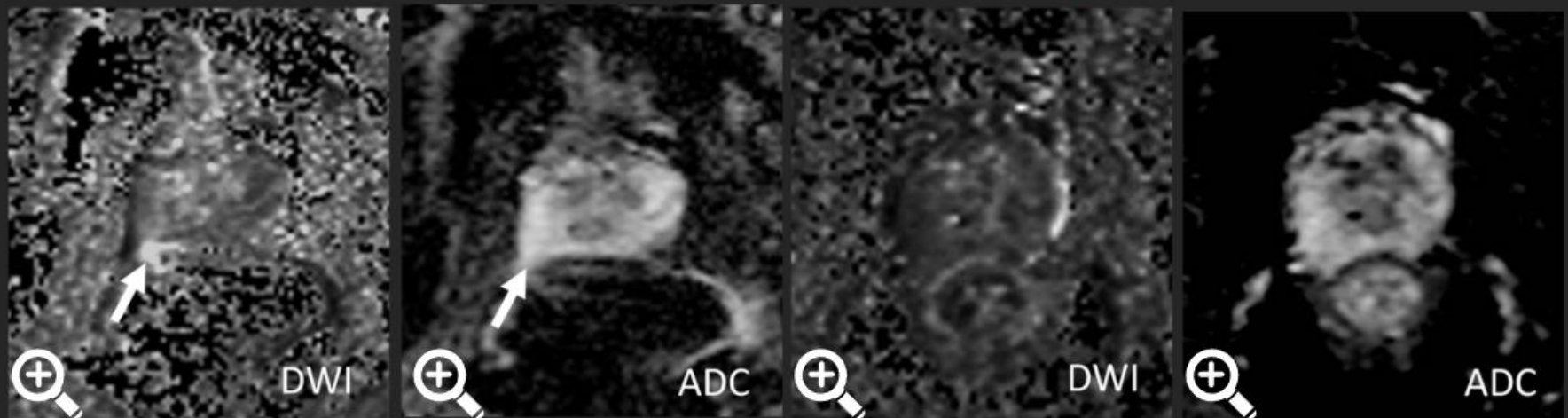
- Prior to the exam, patients should be encouraged to evacuate the rectum to minimize susceptibility artifacts on DWI caused by stool and gas.
- For some patients, the use of enema prior to the exam may help reduce artifacts related to gas and peristalsis.



Patient with collapsed rectum containing no stool or gas, resulting in DWI and ADC images with no susceptibility artifacts or geometric distortion.

Bowel Preparation

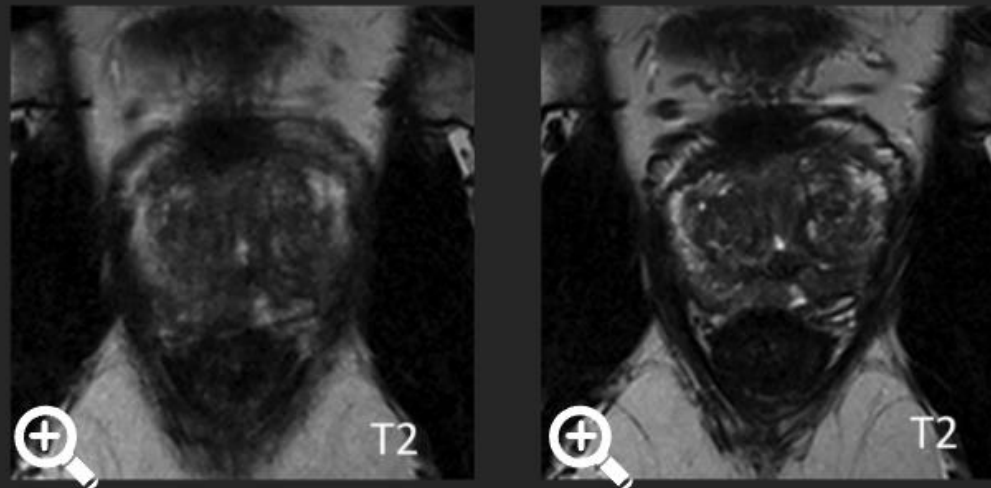
- If susceptibility artifacts that can negatively affect image interpretation are recognized during the exam, DWI images may need to be repeated after the patient tries to evacuate the rectum.
- The use of catheters to remove the gas or rectal administration of water-based gel to displace the gas away from the prostate can also be attempted to mitigate those artifacts.



DWI/ADC images on the left show susceptibility artifacts affecting the assessment of the peripheral zone of the prostate (arrow). Repeat DWI/ADC images on the right after the patient emptied the rectum shows resolution of the artifacts.

Bowel Preparation

- To reduce motion artifact from bowel peristalsis, the use of an antispasmodic agent (e.g. glucagon, scopolamine butylbromide, or sublingual hyoscyamine sulfate) may be beneficial in some patients. However, in many others it is not necessary, and the incremental cost and potential for adverse drug reactions should be taken into consideration.



Axial T2-weighted images obtained before (left) and after (right) the administration of an antiperistalsis agent. The image obtained after administration of the antiperistalsis agent (right) shows resolution of the blurring artifacts from motion.

Ejaculation

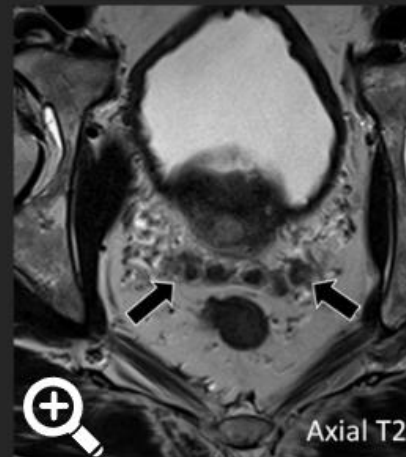
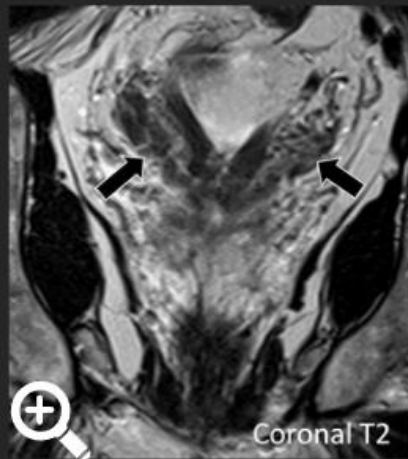
- Avoiding ejaculation for ≥ 72 may improve the distension of the seminal vesicles. The impact of this measure on the detection of clinically significant cancer has not been determined.



Coronal and axial T2 weighted images shows adequately distended seminal vesicles (arrows) in a patient who had last ejaculated > 72 hours prior to the exam.

Ejaculation

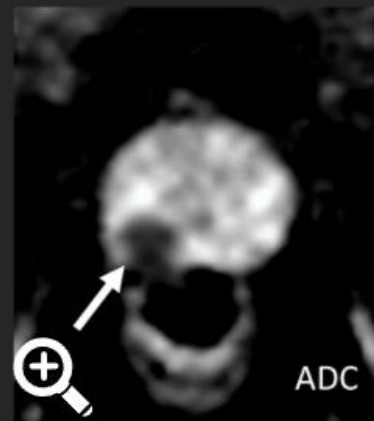
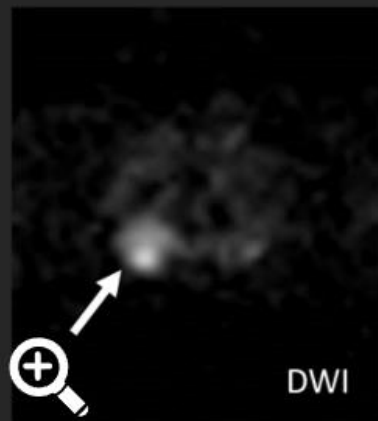
- Avoiding ejaculation for ≥ 72 may improve the distension of the seminal vesicles. The impact of this measure on the detection of clinically significant cancer has not been determined.



Coronal and axial T2 weighted images show collapsed seminal vesicles (arrows) in a patient who had last ejaculated less than 24 hours prior to the exam.

Scanner Strength

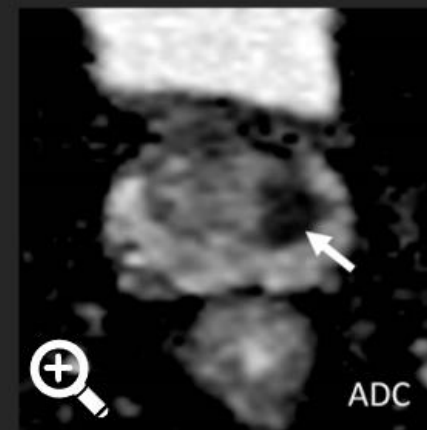
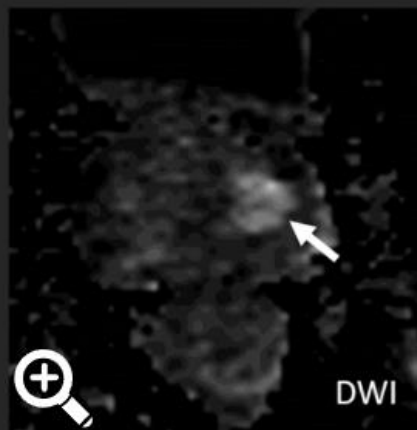
- Only 3T and 1.5T MRI scanners are recommended.
- 3T is generally preferred but 1.5T MRI scanners with multichannel coils can offer good quality images.
- 1.5T MRI scanners may be preferred in patients with implants that are not approved for 3T or that are likely to cause significant susceptibility artifacts (e.g. hip prosthesis).



Multiparametric MRI exam performed on a 1.5T scanner showing a PI-RADS 5 lesion with extra-prostate extension in the right PZ (arrows).

Scanner Strength

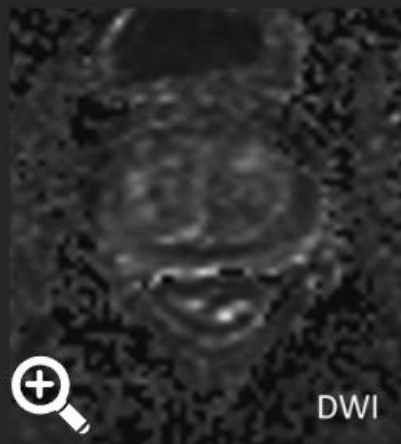
- Only 3T and 1.5T MRI scanners are recommended.
- 3T is generally preferred but 1.5T MRI scanners with multichannel coils can offer good quality images.
- 1.5T MRI scanners may be preferred in patients with implants that are not approved for 3T or that are likely to cause significant susceptibility artifacts (e.g. hip prosthesis).



Biparametric MRI exam performed on a 1.5T scanner showing an atypical nodule (T2WI score 2, DWI/ADC score 5 and overall PI-RADS 3) in the left TZ (arrows).

Scanner Strength

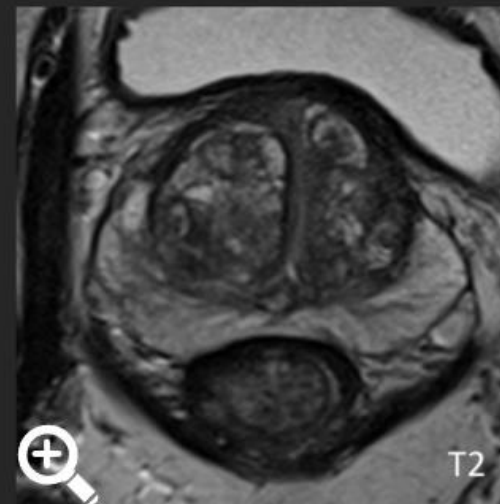
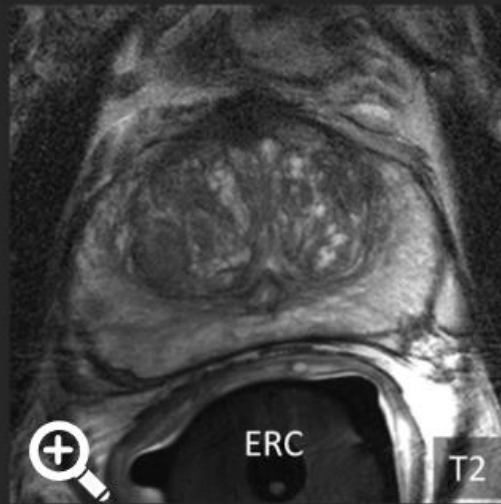
- Only 3T and 1.5T MRI scanners are recommended.
- 3T is generally preferred but 1.5T MRI scanners with multichannel coils can offer good quality images.
- 1.5T MRI scanners may be preferred in patients with implants that are not approved for 3T or that are likely to cause significant susceptibility artifacts (e.g. hip prosthesis).



Multiparametric MRI exam performed on a 1.5T scanner showing no focal lesions in the PZ or TZ (PI-RADS 1)

Coil Selection

- External (surface) coil preferably with high number of external phased array coil elements and RF channels (e.g. 16 or more) .
- Endorectal coil (ERC) is considered optional.



Prostate MRI exams of the same patient performed in a 3T scanner with (left) and without (right) endorectal coil.

T2-weighted images

- Planes: Straight or oblique axial and at least one additional orthogonal plane (i.e., sagittal and/or coronal).
- Sequence type: 2D RARE, more commonly known as fast-spin-echo (FSE) or turbo-spin-echo (TSE).
- FOV: 16-20 cm including prostate and SV
- Slice thickness: 3mm, no gap
- In plane dimension: $\leq 0.7\text{mm}$ (phase) x $\leq 0.4\text{mm}$ (frequency)



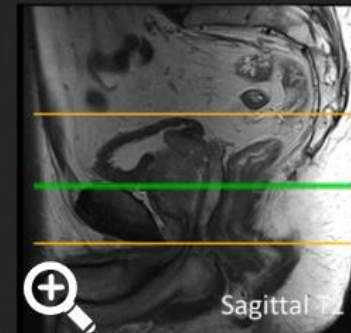
RARE: rapid acquisition with relaxation enhancement

T2-weighted images

- Planes: Straight or oblique axial and at least one additional orthogonal plane (i.e., sagittal and/or coronal).
- Sequence type: 2D RARE, more commonly known as fast-spin-echo (FSE) or turbo-spin-echo (TSE).
- FOV: 16-20 cm including prostate and SV
- Slice thickness: 3mm, no gap
- In plane dimension: $\leq 0.7\text{mm}$ (phase) x $\leq 0.4\text{mm}$ (frequency)



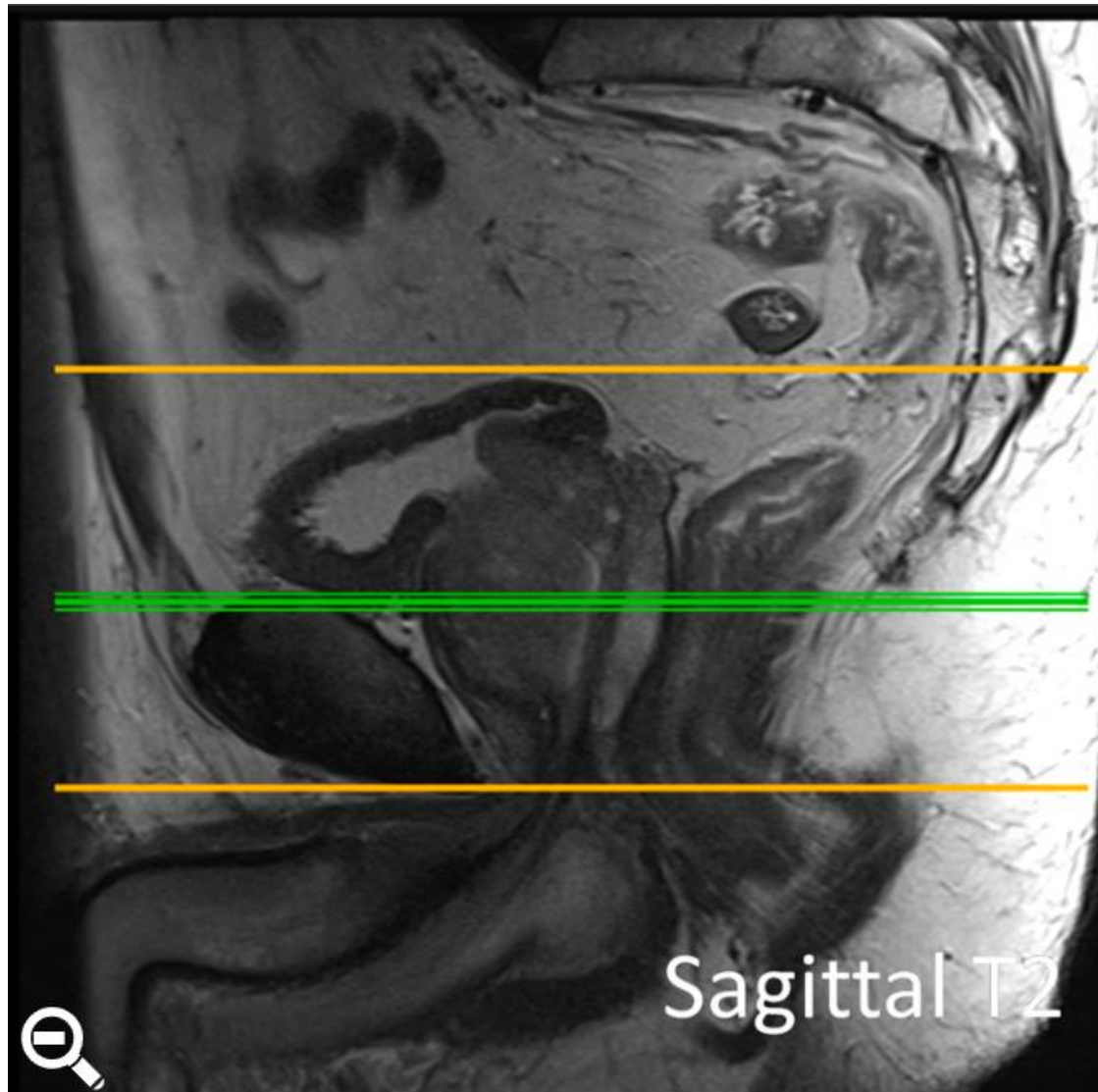
Axial T2



Sagittal T2

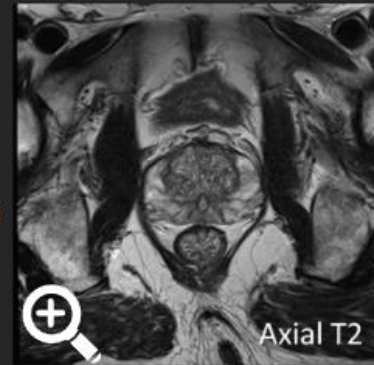
Straight axial T2WI obtained perpendicular to the long axis of the patient. The green line in the sagittal image indicates the acquisition plane and orange lines indicate the scan range, which should include the entire prostate and seminal vesicles.

RARE: rapid acquisition with relaxation enhancement

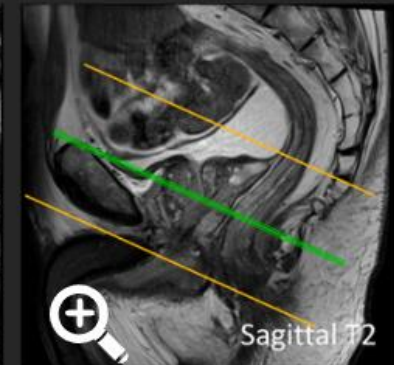


T2-weighted images

- Planes: Straight or oblique axial and at least one additional orthogonal plane (i.e., sagittal and/or coronal).
- Sequence type: 2D RARE, more commonly known as fast-spin-echo (FSE) or turbo-spin-echo (TSE).
- FOV: 16-20 cm including prostate and SV
- Slice thickness: 3mm, no gap
- In plane dimension: $\leq 0.7\text{mm}$ (phase) x $\leq 0.4\text{mm}$ (frequency)



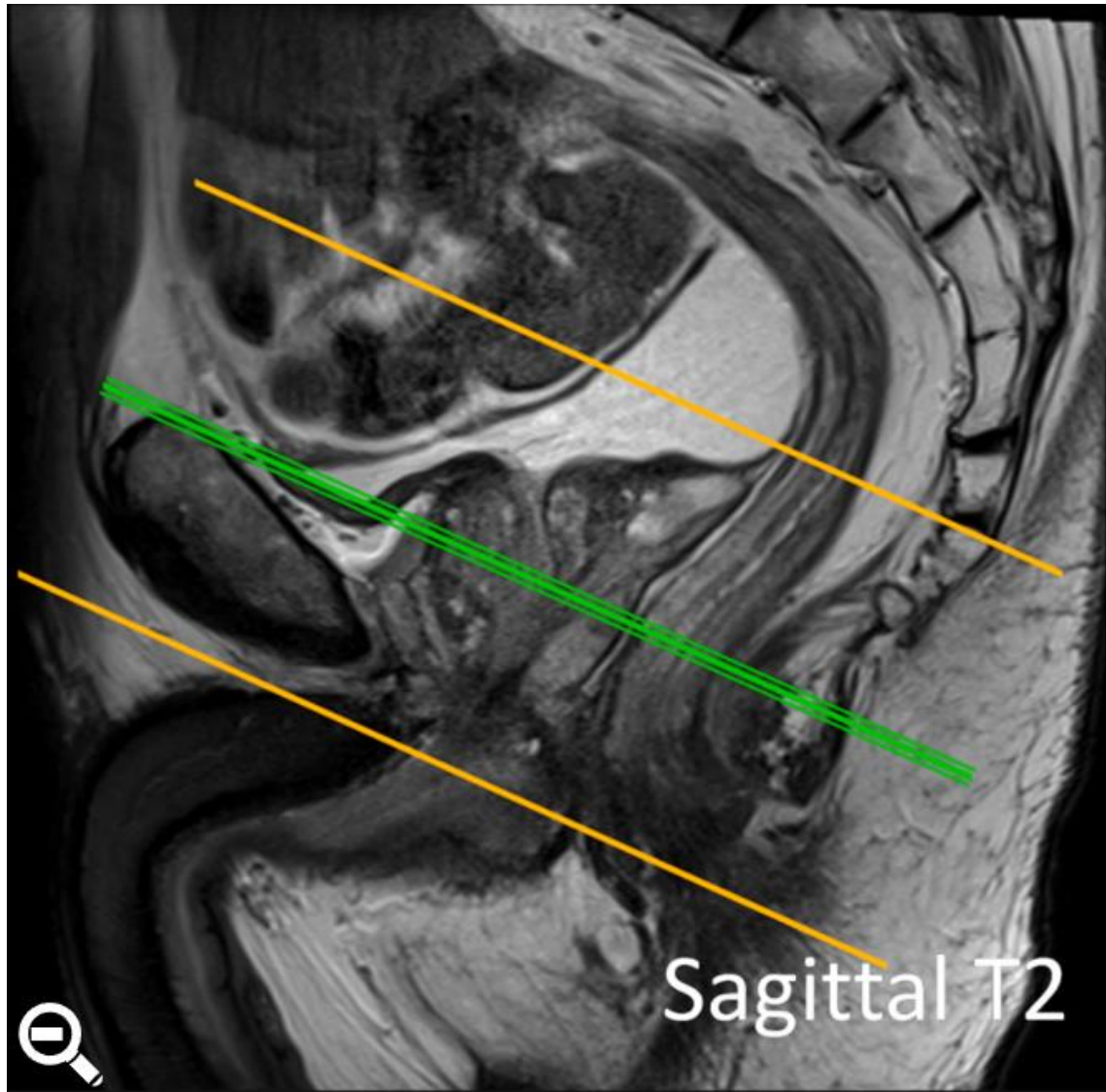
Axial T2



Sagittal T2

Oblique axial T2WI obtained perpendicular to the long axis of the prostate. The green line in the sagittal image indicates the acquisition plane and orange lines indicate the scan range, which should include the entire prostate and seminal vesicles.

RARE: rapid acquisition with relaxation enhancement



T2-weighted images

❑ 3D T2W

- Often obtained for MRI-guided biopsies that use MRI/US fusion software.
- May be useful for visualizing detailed anatomy and distinguishing between genuine lesions and partial volume averaging effects.
- Allows multiplanar reconstruction obviating the need for acquisition of images in different planes.
- The soft tissue contrast and in-plane resolution may be lower than 2D images.

Multiplanar 2D TSE

Acquisition time 1:55



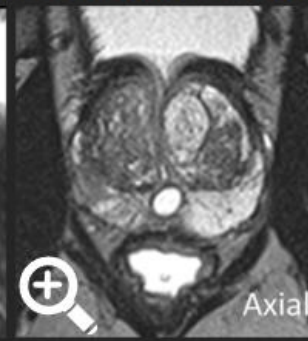
Acquisition time 2:53



Acquisition time 2:31

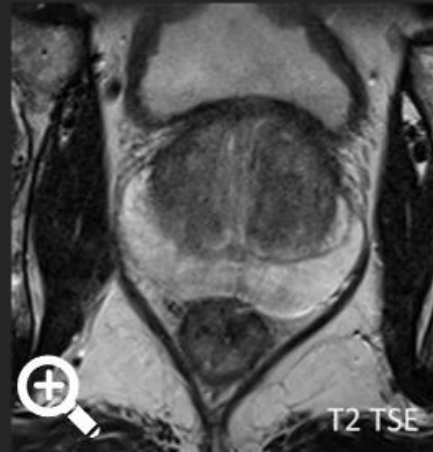


3D T2 with multiplanar reconstructions - total acquisition time: 6:04



T2-weighted images

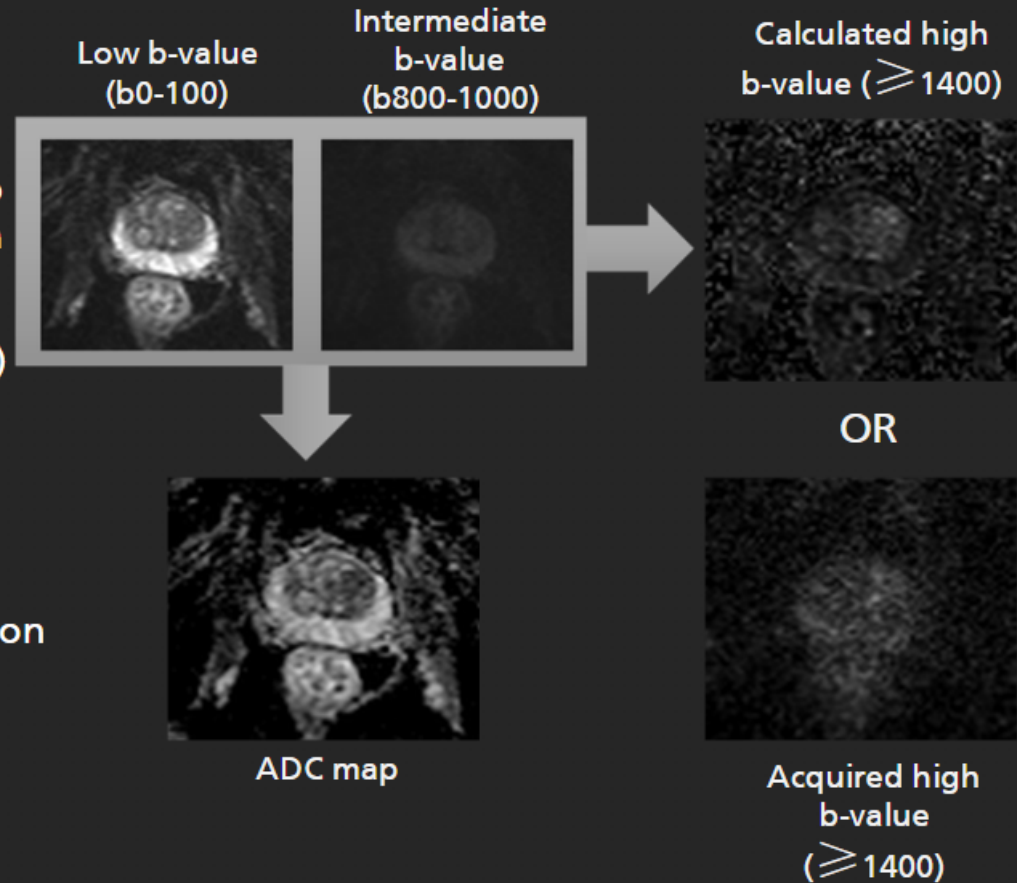
- Optional Sequences:
 - ❑ Pulse sequences that sample strips of data in a rotating fashion around the center of k-space can be used to reduce motion related artifacts.
- Sequence name varies according to vendors
 - PROPELLER (GE), BLADE (Siemens), Multivane (Philips), RADAR (Hitachi), and Jet (Canon).



Axial T2 TSE image shows blurring of the prostate due to motion related artifacts which are eliminated in the T2 BLADE sequence.

Diffusion weighted images

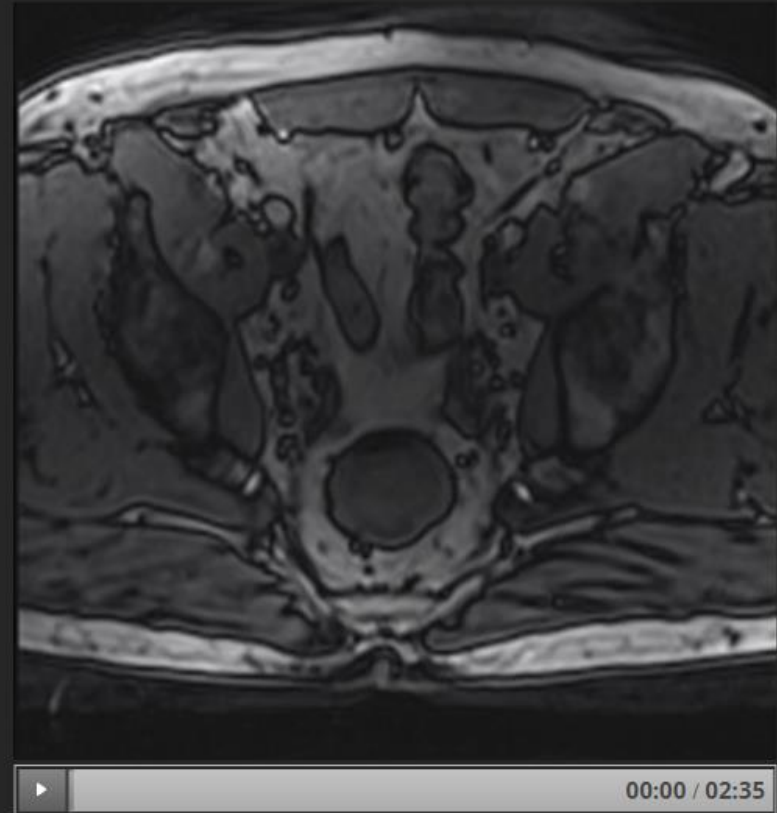
- Plane: Axial (same as T2WI)
- Sequence type: Free-breathing spin echo EPI combined with spectral fat saturation
- Mandatory b-values (in mm/s²)
 - Low (0-100) and intermediate (800-1000) b-values for ADC map calculation
 - High b-value (≥ 1400)
 - ❑ Can be calculated from low/intermediate b-values or acquired separately to avoid diffusion kurtosis effect on ADC



EPI: Echo planar imaging

Dynamic contrast enhanced (DCE) T1-weighted images

- Plane: Axial (matching T2W and DWI)
- Sequence type: T1 GRE
 - 3D preferred over 2D
- Fat suppression technique or imaging subtraction
- TE <5 msec ; TR <100 msec
- Slice thickness: 3mm, no gap
- In plane dimension: <2 mm phase and frequency
- Temporal resolution: ≤ 15 sec
- Duration: ≥ 2 minutes
- Contrast dose: 0.1 mmol/kg;
- Injection rate: 2-3cc/sec



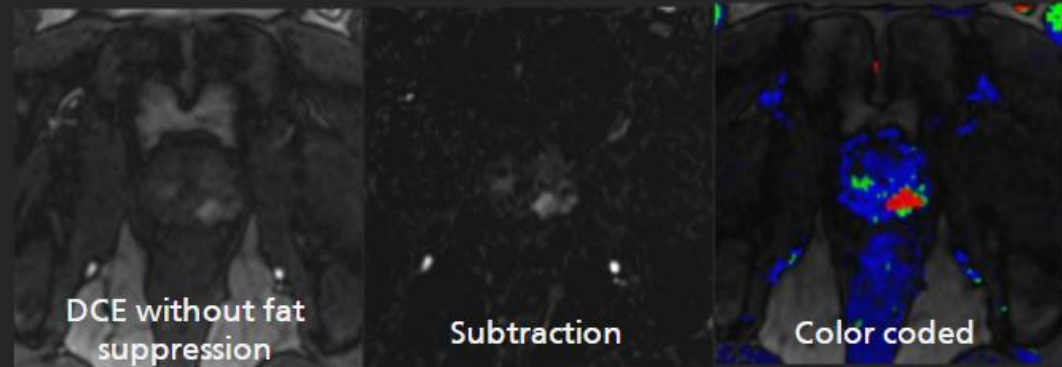
GRE: Gradient Edge

Slide 20 of 24

T1-weighted DCE images obtained through the pelvis before and after the IV administration of gadolinium-based contrast agent.

Dynamic contrast enhanced (DCE) T1-weighted images

- Plane: Axial (matching T2W and DWI)
- Sequence type: T1 GRE
 - 3D preferred over 2D
- Fat suppression technique or imaging subtraction
- TE <5 msec ; TR <100 msec
- Slice thickness: 3mm, no gap
- In plane dimension: <2 mm phase and frequency
- Temporal resolution: ≤ 15 sec
- Duration: ≥ 2 minutes
- Contrast dose: 0.1 mmol/kg;
- Injection rate: 2-3cc/sec

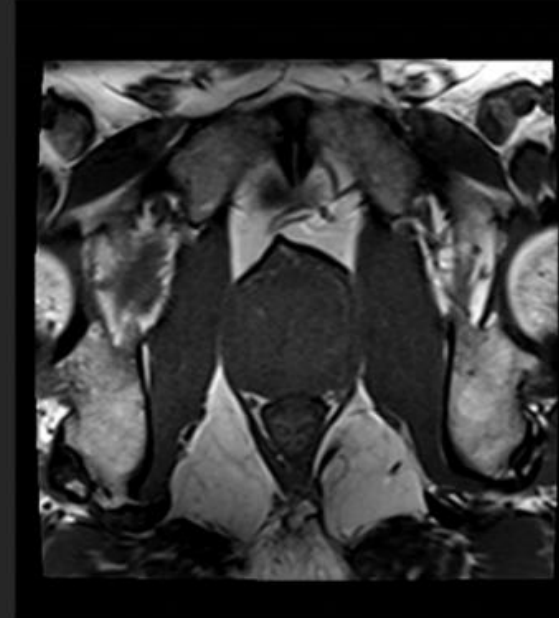


Visual assessment of enhancement may be improved with fat suppression or subtraction techniques (especially in the presence of blood products that are hyperintense on pre-contrast enhanced T1W). Visual assessment of enhancement may also be assisted with a parametric map which color-codes enhancement features. However, any suspicious finding on subtracted images or a parametric map should always be confirmed on the source images.

GRE: Gradient Edge

T1-weighted images

- Used for evaluation of post biopsy hemorrhage, lymph nodes and bone lesions.
- Plane: Axial
- Sequence type: TSE or GRE with or without fat suppression
- Alternatives:
 - First time point from DCE acquisition
 - 3D T1 GRE image using Dixon method



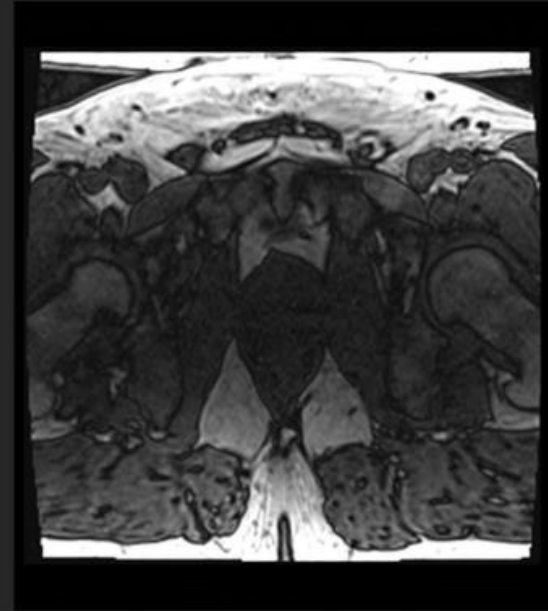
T1 TSE – Acquisition time 2:25

Examples

1 2 3

T1-weighted images

- Used for evaluation of post biopsy hemorrhage, lymph nodes and bone lesions.
- Plane: Axial
- Sequence type: TSE or GRE with or without fat suppression
- Alternatives:
 - First time point from DCE acquisition
 - 3D T1 GRE image using Dixon method



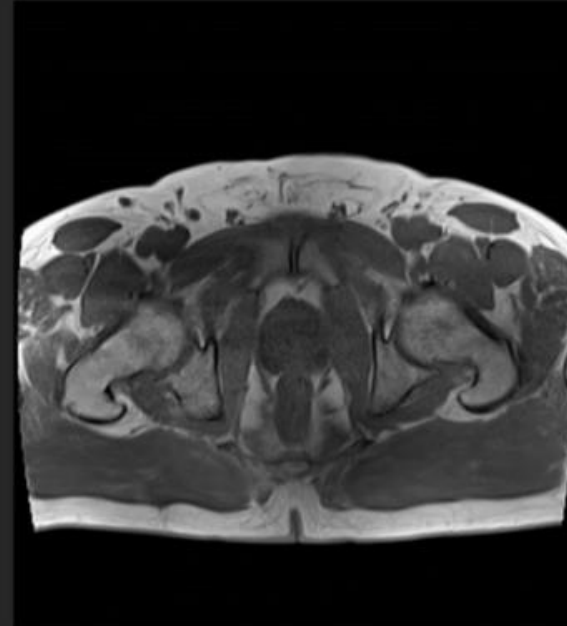
3D T1 GRE - First time point of DCE image acquisition, obtained immediately before contrast is injected. No extra-time is required.

Examples

1 2 3

T1-weighted images

- Used for evaluation of post biopsy hemorrhage, lymph nodes and bone lesions.
- Plane: Axial
- Sequence type: TSE or GRE with or without fat suppression
- Alternatives:
 - First time point from DCE acquisition
 - 3D T1 GRE image using Dixon method



3D T1 GRE Dixon – Acquisition time 00:10.

Examples

1 2 3

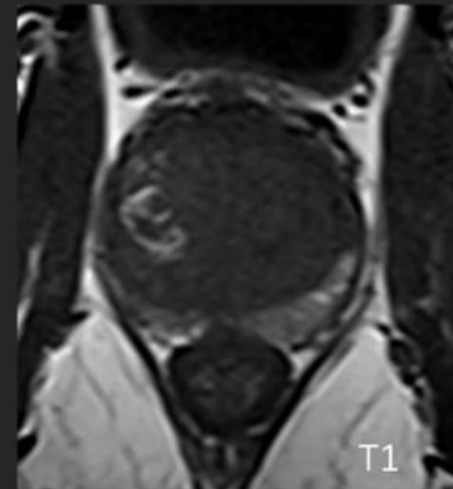
What is the suggested interval between biopsy and MRI?

A. Less than 6 weeks

B. At least 6 weeks

C. Greater than 8 weeks

D. At least 6-8 months



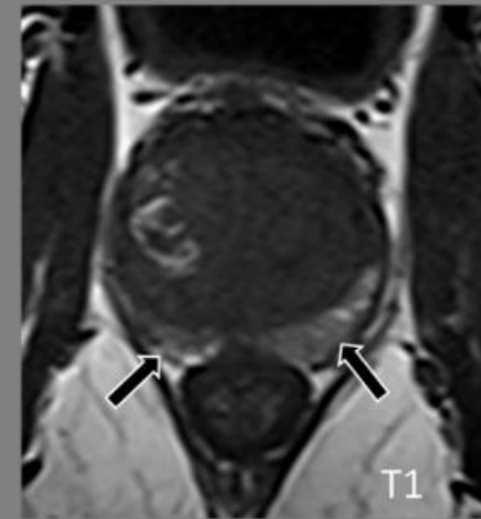
Question 1 of 7

Submit

Correct

That's right! Answer: b. At least 6 weeks

Explanation: An interval of at least 6 weeks is recommended to minimize the impact of post biopsy changes on prostate MRI interpretation.



Continue

B. At least 6 weeks

Which of the following sequences is most sensitive to geometric artifacts from stool and gas in the rectum?

A. T2-weighted images

B. T1-weighted images

C. Diffusion weighted images

D. Dynamic contrast enhanced images

Question 2 of 7

Submit

Correct

That's right! Answer: c. Diffusion weighted images
Explanation: Rectal distension with stool and gas can cause susceptibility artifacts on diffusion weighted images.

C. Diffusion weighted images

Parameters

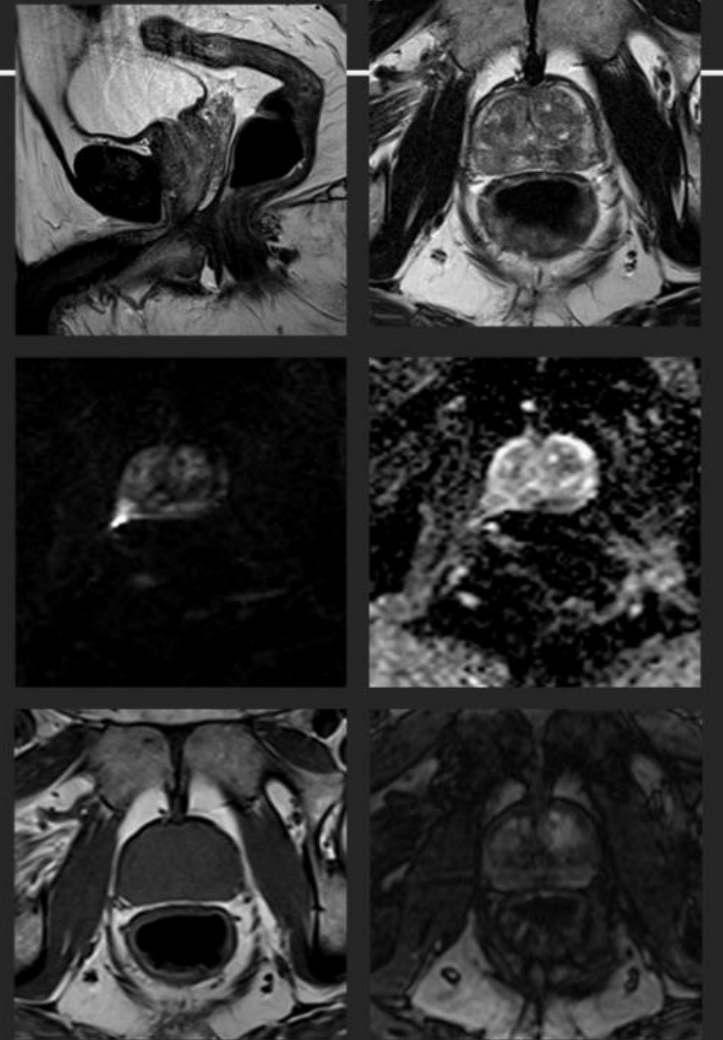
Knowledge Check

Which of the following preparation instructions could have improved the most the quality of this prostate MRI exam the most?

- A. Interval between biopsy and MRI of at least 6-8 weeks
- B. Antiperistalsis agents
- C. Empty the bladder before the exam
- D. Empty the rectum before the exam

Submit

Question 3 of 7



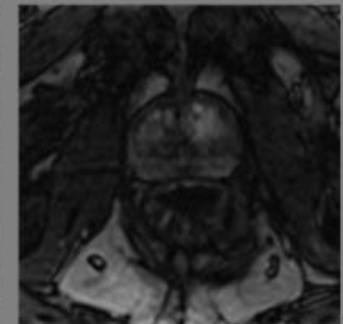
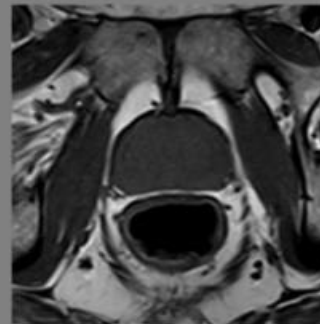
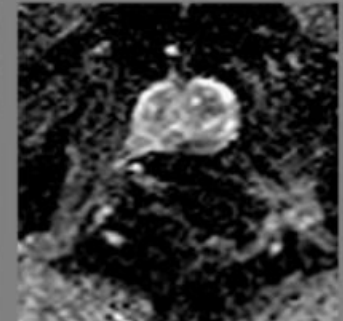
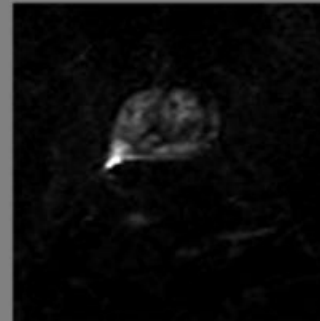
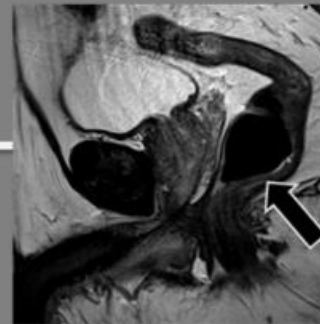
Correct

That's right! Answer: c. Empty the rectum before the exam

Explanation: Patients should try to empty the rectum before the exam to minimize susceptibility artifacts on diffusion weighted images.

Continue

D. Empty the rectum before the exam



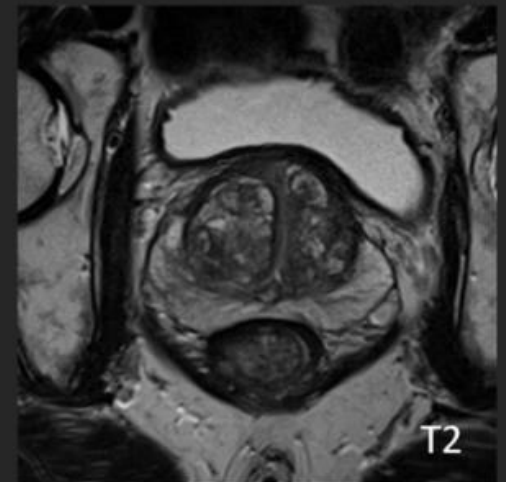
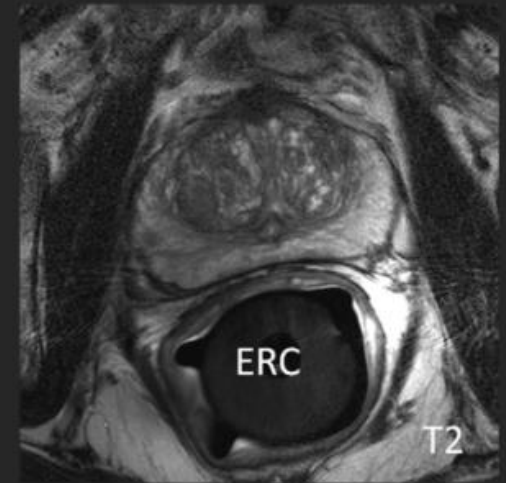
What is the current recommendation regarding the use of endorectal coil (ERC)?

A. Not recommended

B. Must be used when the exam is performed on scanners with magnet strength of 1.5T

C. Must be used when exam performed on scanners with magnet strength < 1.5T

D. Considered optional for 1.5T or 3T



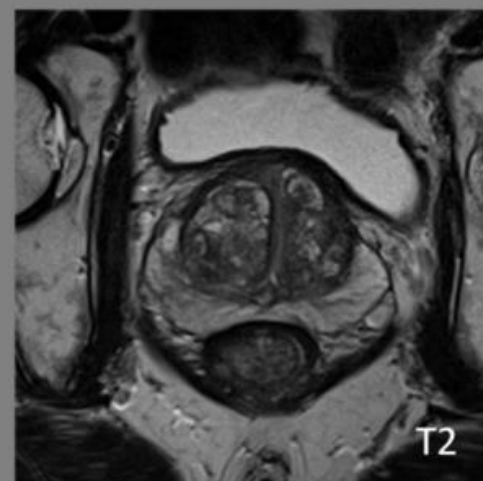
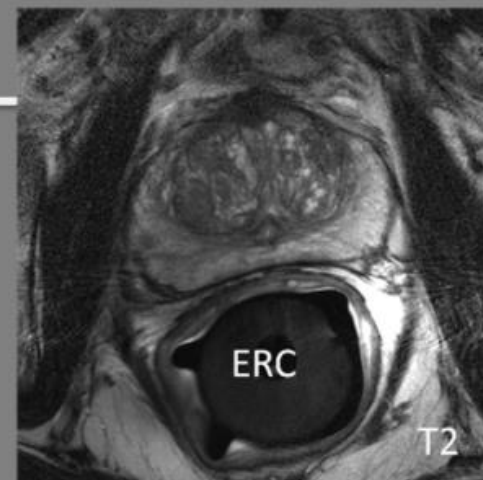
Question 4 of 7

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Correct

That's right! Answer: d. Considered optional for 1.5T or 3T

Explanation: Even though higher SNR may be achieved with an ERC, its use is considered optional due to important trade-offs such as cost and patient discomfort.

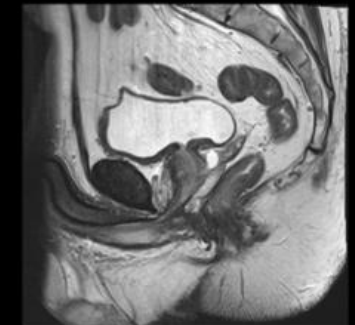
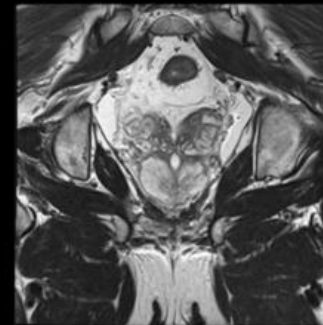


Continue

D. Considered optional for 1.5T or 3T

Which planes are required for T2WI?

- A. Axial (straight or oblique), and at least one orthogonal plane
- B. Axial (straight and oblique) and at least one orthogonal plane
- C. Axial (straight or oblique) and two orthogonal planes
- D. Axial, sagittal and coronal



Question 5 of 7

Submit

Correct

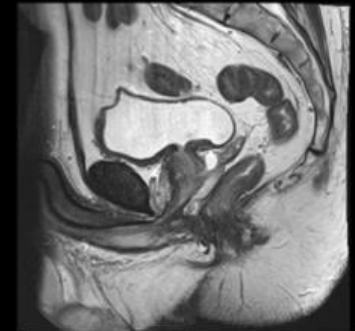
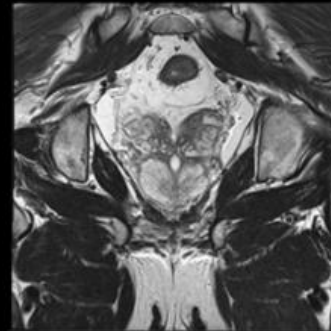
That's right! Answer: a. Axial (straight or oblique), and at least one orthogonal plane

A. Axial (straight or oblique), and at least one orthogonal plane

Continue



Axial (straight or oblique)
+
coronal AND/OR sagittal



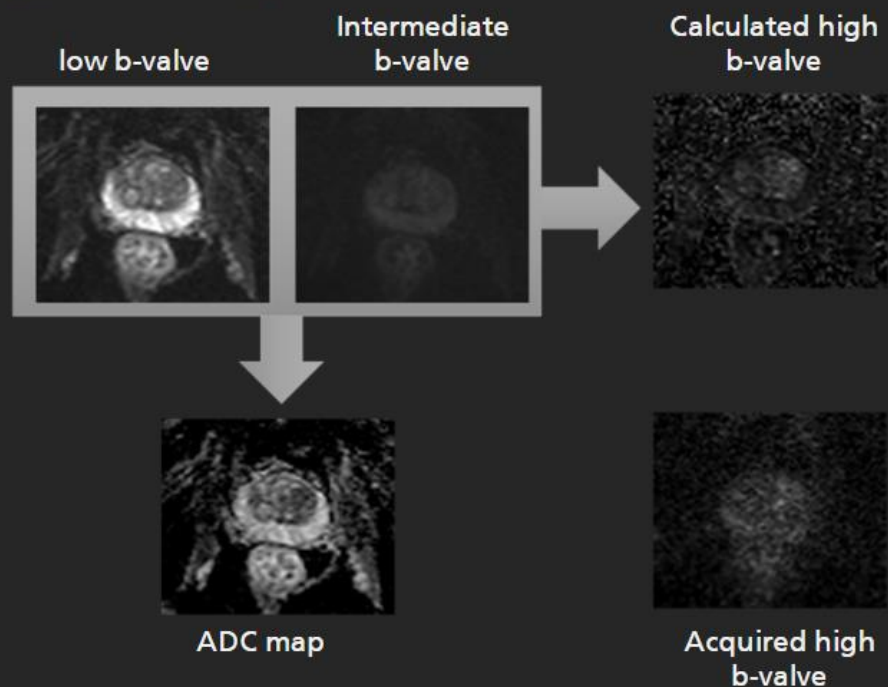
Which sets of low, intermediate and high b-values (in mm/s²) are required for diffusion weighted images?

A. 0-50, 500-800 and ≥ 1000

B. 0-100, 800-1000 and ≥ 1400

C. 0-100, 500-1000 and ≥ 2000

D. 0-50, 500-800 and ≥ 2000



Question 6 of 7

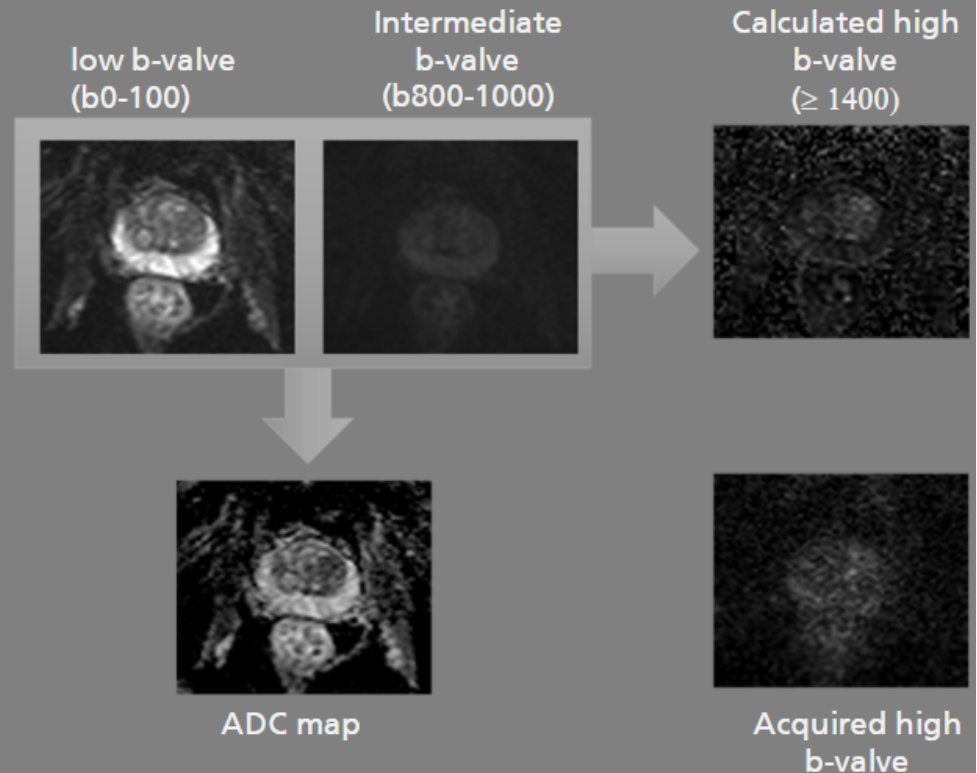
Submit

Correct

That's right! Answer: b. 0-100, 800-1000 and ≥ 1400

Explanation: The low and intermediate b-values DWI must be acquired for ADC map calculation. The high b-value DWI can be calculated from the low and intermediate b-value images or acquired separately. If acquired, the high b-value DWI should not be included in the ADC map generation to avoid kurtosis effect resulting in lower than expected apparent diffusion coefficient.

Continue



B. 0-100, 800-1000 and ≥ 1400

Which set of parameters is recommended for dynamic contrast enhanced T1-weighted images?

A. 3D GRE T1 with temporal resolution $\leq 15\text{sec}$

B. 3D GRE T1 with temporal resolution and $\geq 15\text{sec}$

C. 2D GRE T1 with temporal resolution $\geq 10\text{sec}$

D. 2D GRE T1 with temporal resolution $\leq 10\text{sec}$

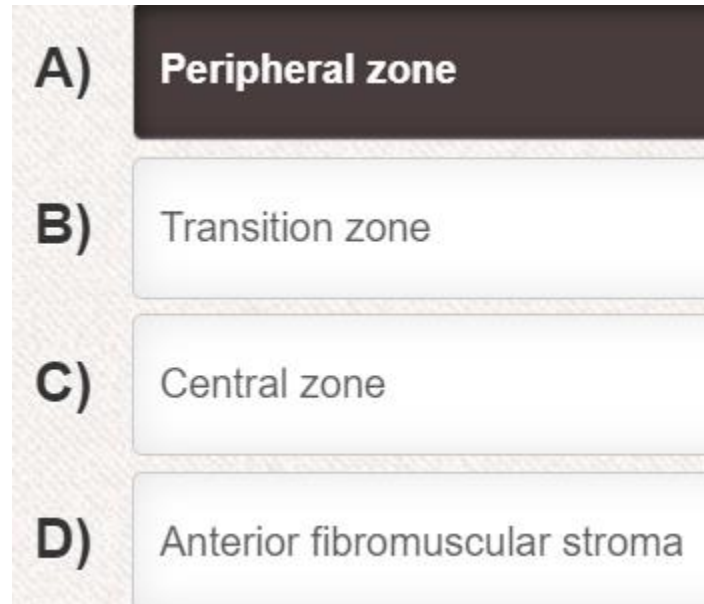
Question 7 of 7

Submit

Correct

That's right! Answer: a. 3D GRE with temporal resolution ≤ 15 sec
Explanation: 3D GRE T1 is preferred over 2D GRE T1, and the temporal resolution should not exceed 15 sec.

A. 3D GRE T1 with temporal resolution ≤ 15 sec



Which PI-RADS assessment category should be assigned to a 1 cm transition zone abnormality that has a T2WI score 3 AND DWI/ADC score 4:

+ Immagini correlate

A) PI-RADS 1

B) PI-RADS 2

C) PI-RADS 3

D) PI-RADS 4

E) PI-RADS 5

Domanda 3 di 10

Which planes are required for T2WI?

+ Immagini correlate

- A) Axial (straight or oblique), and at least one orthogonal plane**
- B) Axial (straight and oblique), and at least one orthogonal
- C) Axial (straight or oblique) and two orthogonal planes
- D) Axial, sagittal and coronal

RM Prostata

Domanda 4 di 10

What is the T stage of this tumor?

+ Immagini correlate

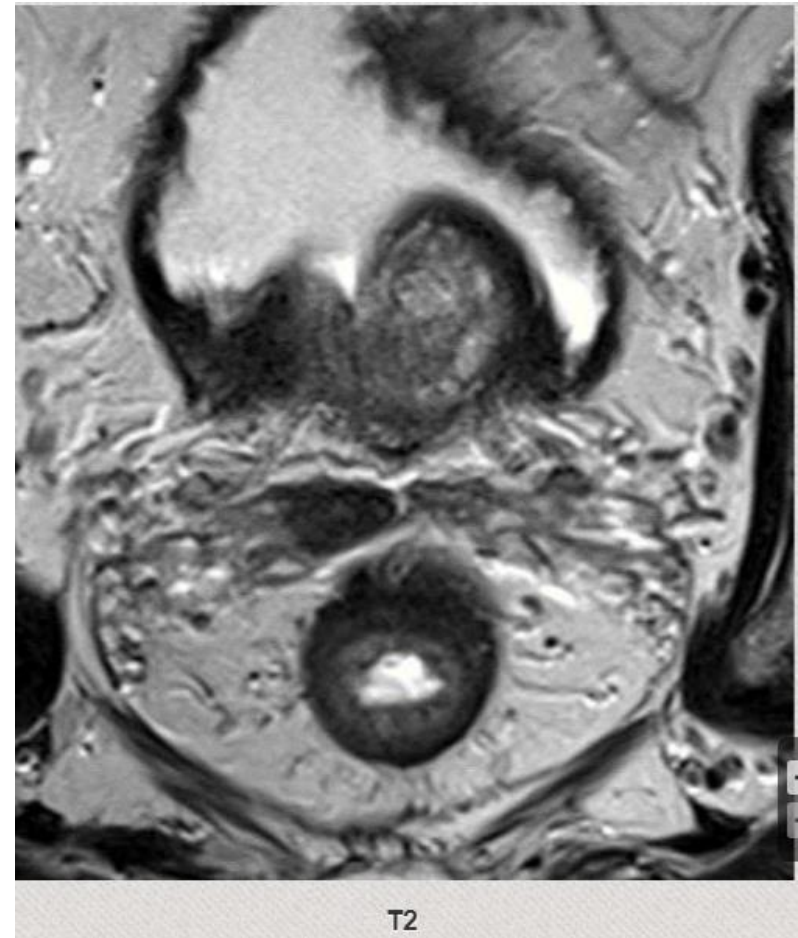
A) T1

B) T2

C) T3a

D) T3b

E) T4



Which of the following is the dominant parameter for scoring abnormalities located in the transition zone?

+ Immagini correlate

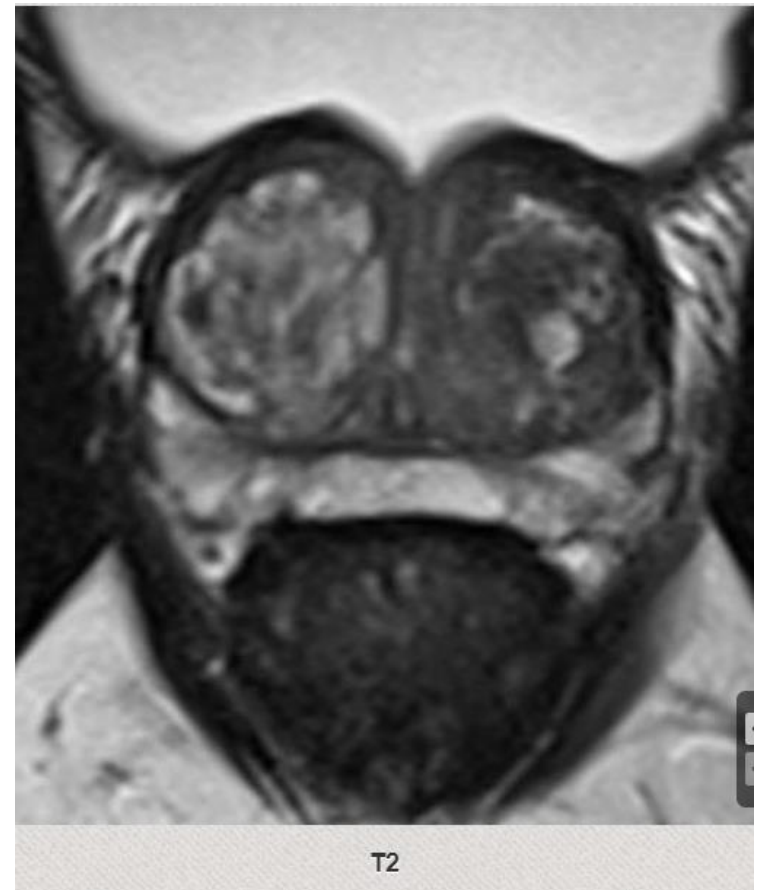
- A) T2WI
- B) DWI/ADC
- C) Dynamic contrast enhanced T1WI
- D) MR spectroscopy

RM Prostata

According to the images provided below, which pi-rads assessment category should be assigned for the abnormalities in the PZ?

+ Immagini correlate

- A) PI-RADS 1
- B) PI-RADS 2**
- C) PI-RADS 3
- D) PI-RADS 4
- E) PI-RADS 5



Domanda 7 di 10

Which of the following lesions would be considered the index lesion?

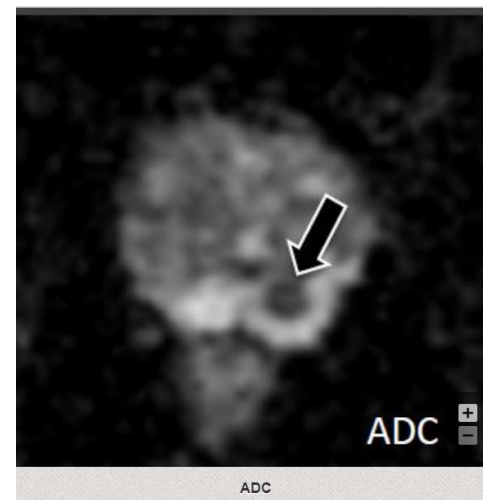
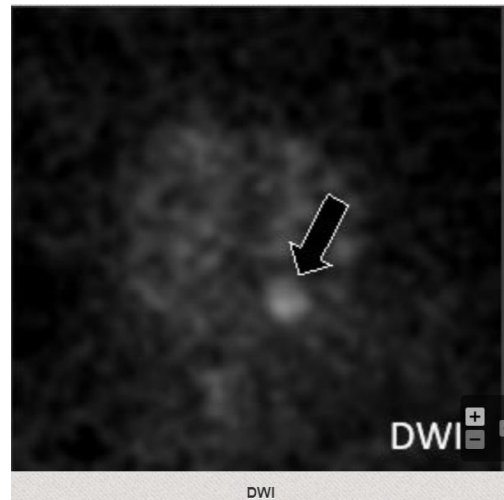
- A) 2 cm PI-RADS 3 lesion
- B) 1.7 cm PI-RADS 4 lesion
- C) 1.6 cm PI-RADS 5 lesion without extraprostatic extension
- D) 1.4 cm PI-RADS 5 lesion with extraprostatic extension**

RM Prostata

Which PI-RADS assessment category should be assigned to this PZ abnormality?

+ Immagini correlate

- A) PI-RADS 1
- B) PI-RADS 2**
- C) PI-RADS 3
- D) PI-RADS 4
- E) PI-RADS 5



Domanda 9 di 10

Which are the required b-values for DWI acquisition?

+ Immagini correlate

- A) 0-50, 500-800 and ≥ 1000
- B) 0-100, 800-1000 and ≥ 1400**
- C) 0-100, 500-1000 and ≥ 2000
- D) 0-50, 500-800 and ≥ 2000

Domanda 10 di 10

The PSA density of a patient with a serum PSA of 12 ng/mL and a prostate gland volume of 38 mL is:

A) 456

B) 3.16

C) 0.31

D) 0.031

Punteggio

100,00%

Superato

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