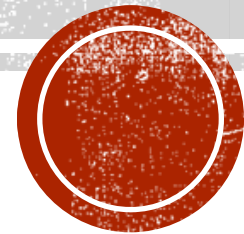


TZ CANCER

Ali Akbarzade Pasha MD



PI-RADS

PI-RADS 1 = Very low - clinically significant cancer highly unlikely

PI-RADS 2 = Low - clinically significant cancer unlikely

PI-RADS 3 = Intermediate - clinically significant cancer equivocal

PI-RADS 4 = High - clinically significant cancer likely

PI-RADS 5 = Very high - clinically significant cancer highly likely



T2WI SCORE (PI-RADS v2.1)

For **transition zone**

normal (rare), or a round, completely encapsulated nodule ("typical nodule")

T2WI

1

a mostly encapsulated nodule or a homogeneous circumscribed nodule without encapsulation ("atypical nodule"); or a homogeneous mildly hypointense area between nodules

T2WI

2

heterogeneous signal intensity with obscured margins; includes others that do not qualify as 2, 4, or 5

T2WI

3

lenticular or non-circumscribed, homogenous, moderately hypointense, and <1.5 cm

T2WI

4

lenticular or non-circumscribed, homogenous, moderately hypointense, and ≥ 1.5 cm; or definite extraprostatic extension/invasive behavior

T2WI

5

DWI SCORE (PI-RADS v2.1)

For **peripheral zone** and **transition zone**

DWI

1

no abnormal diffusion restriction

DWI

2

linear/wedge shaped diffusion restriction

DWI

3

focal, mild/moderate diffusion restriction; may be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both

DWI

4

focal, marked diffusion restriction, <1.5 cm

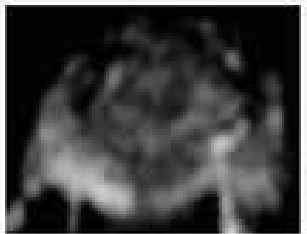
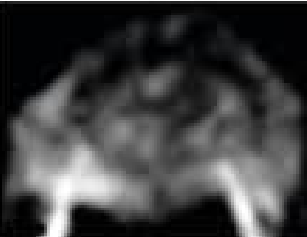
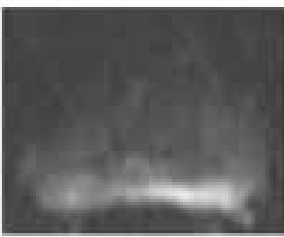
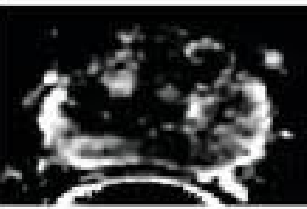
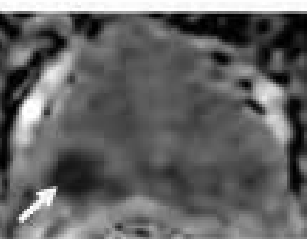
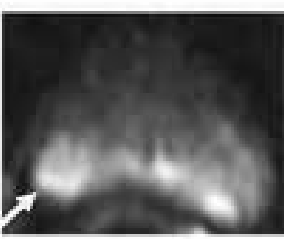
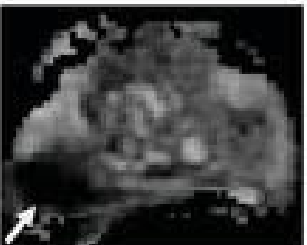
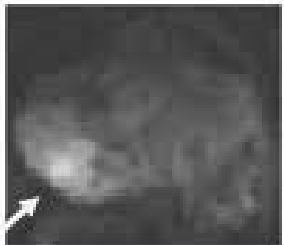
DWI

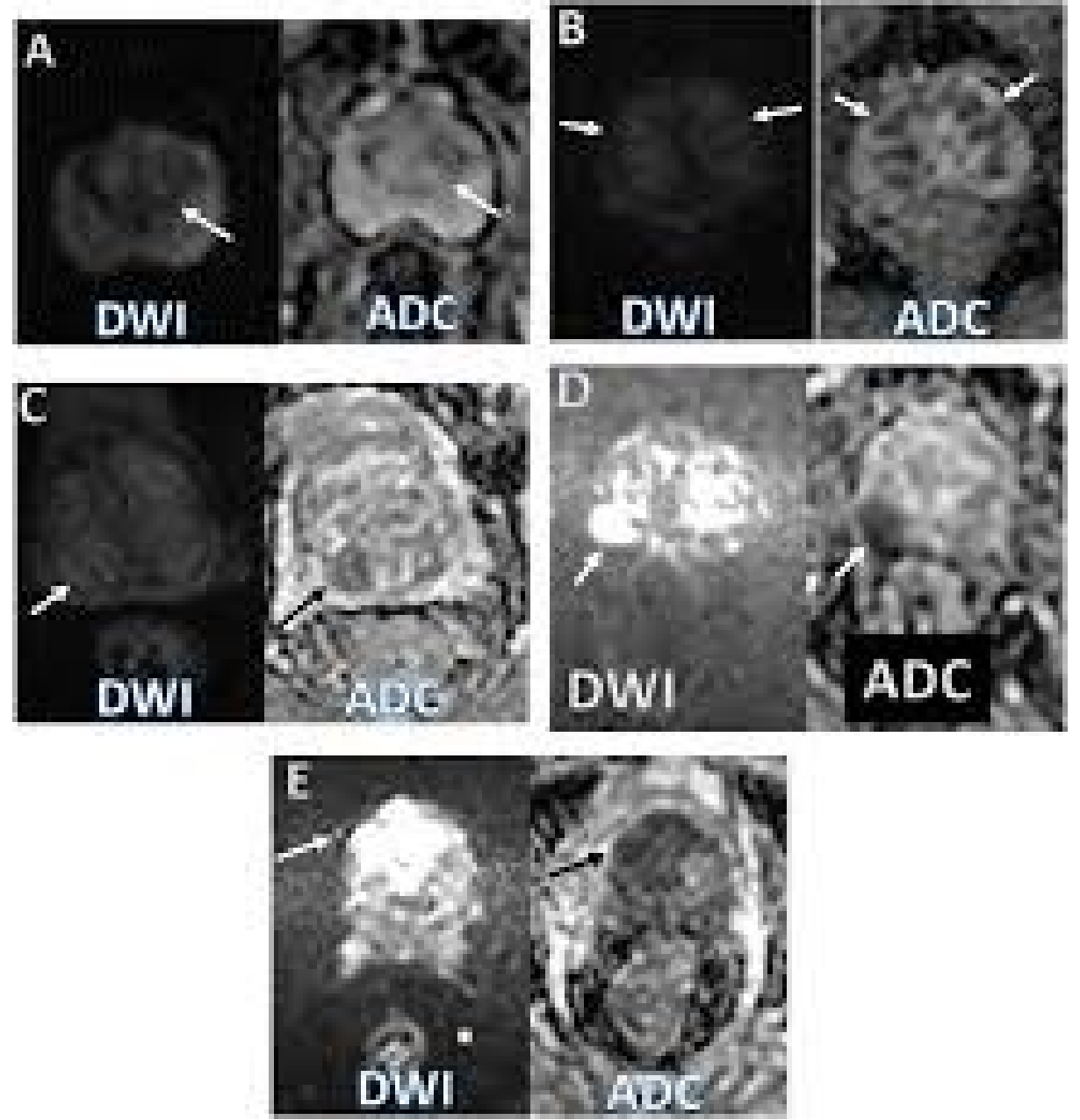
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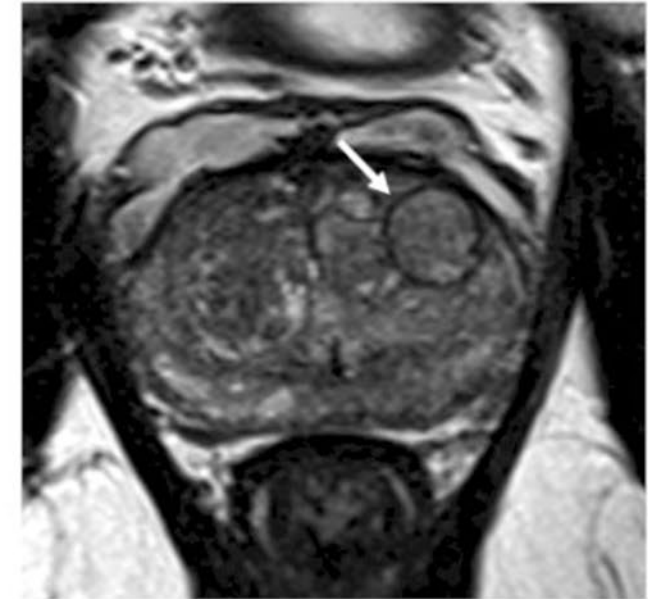
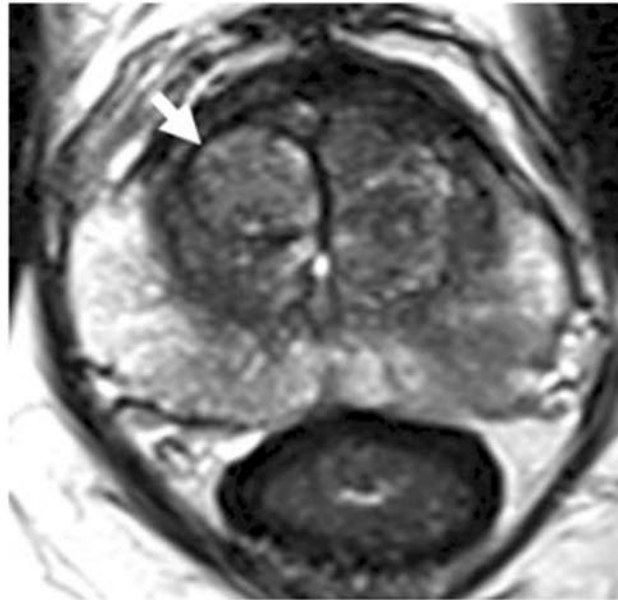
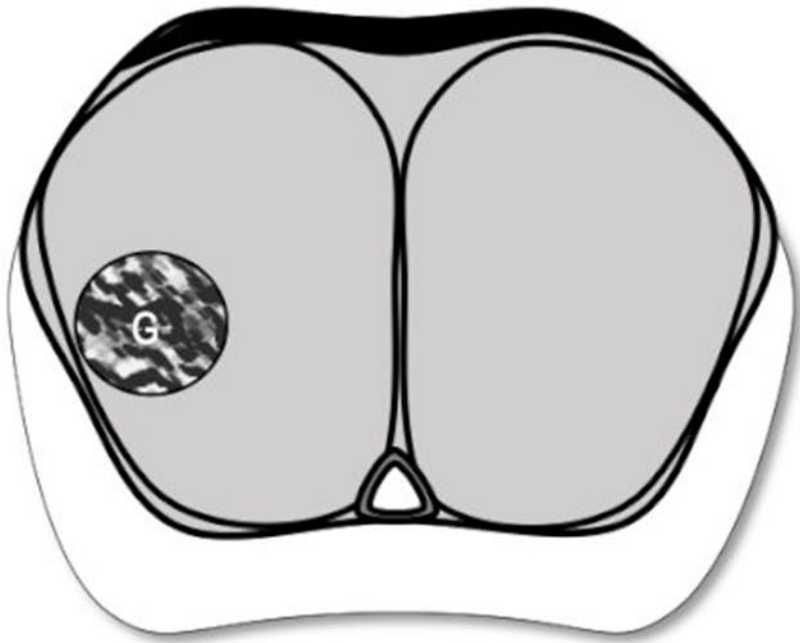
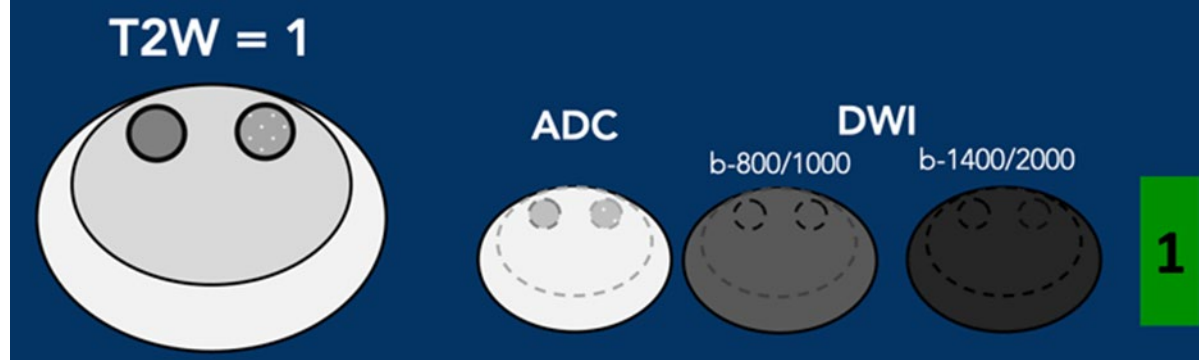
focal, marked diffusion restriction, ≥ 1.5 cm; or definite extraprostatic extension/invasive behavior

Diffusion restriction = hypointensity on ADC and/or hyperintensity on high b-value DWI



Score	ADC	DWI	Description
1			No abnormality (i.e., normal) on ADC and high b-value DWI
2			Indistinct hypointense on ADC
3			Focal mildly/moderately hypointense on ADC and isointense/mildly hyperintense on high b-value DWI
4			Focal markedly hypointense on ADC and markedly hyperintense on high b-value DWI; <1.5 cm in greatest dimension
5			Same as 4 but ≥1.5 cm in greatest dimension or definite extraprostatic extension/invasive behavior



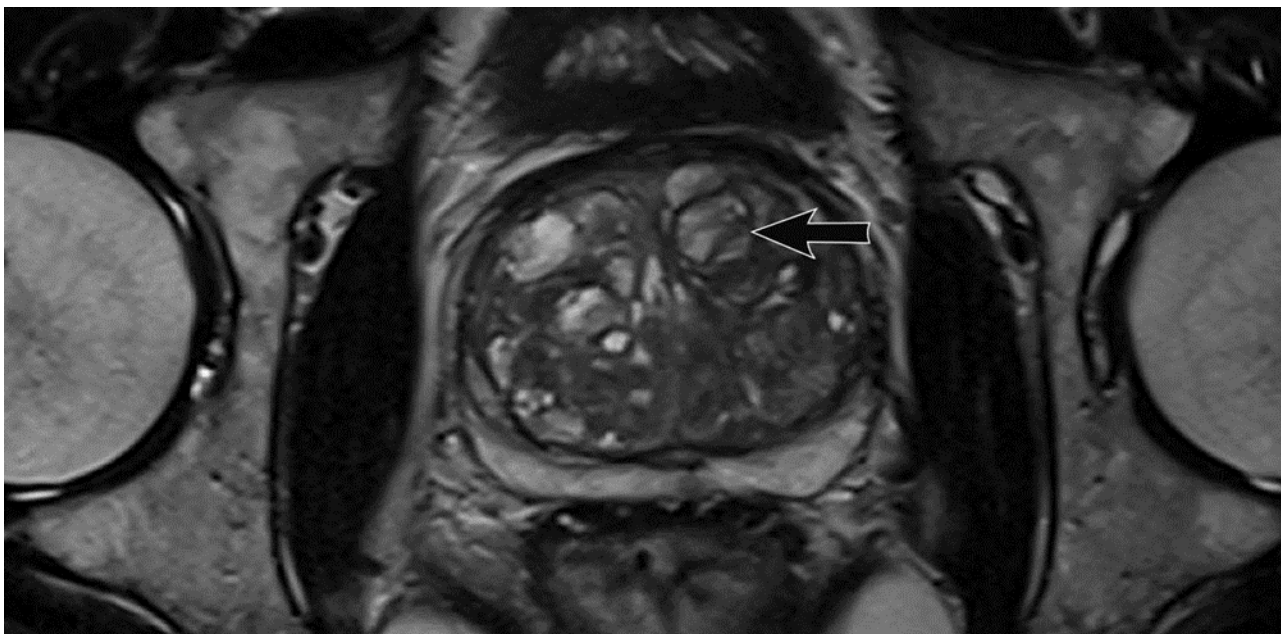


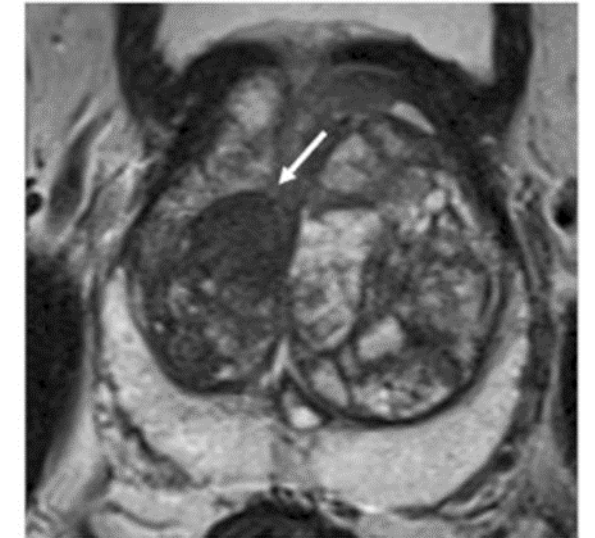
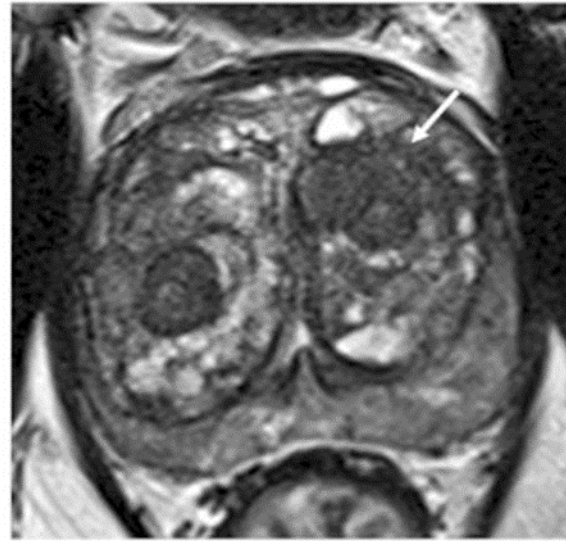
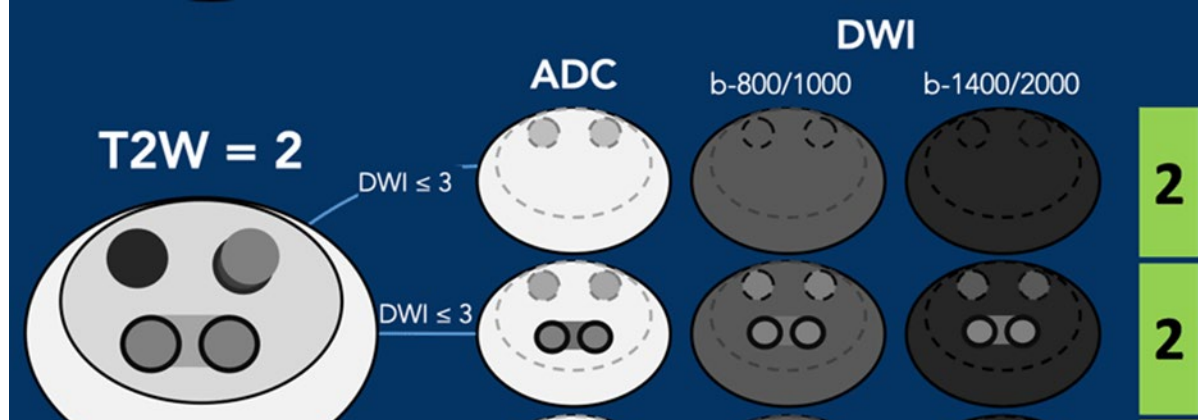
T2W score of 1

Normal appearing transition zone (rare)

Round, completely encapsulated nodule (“typical nodule”)







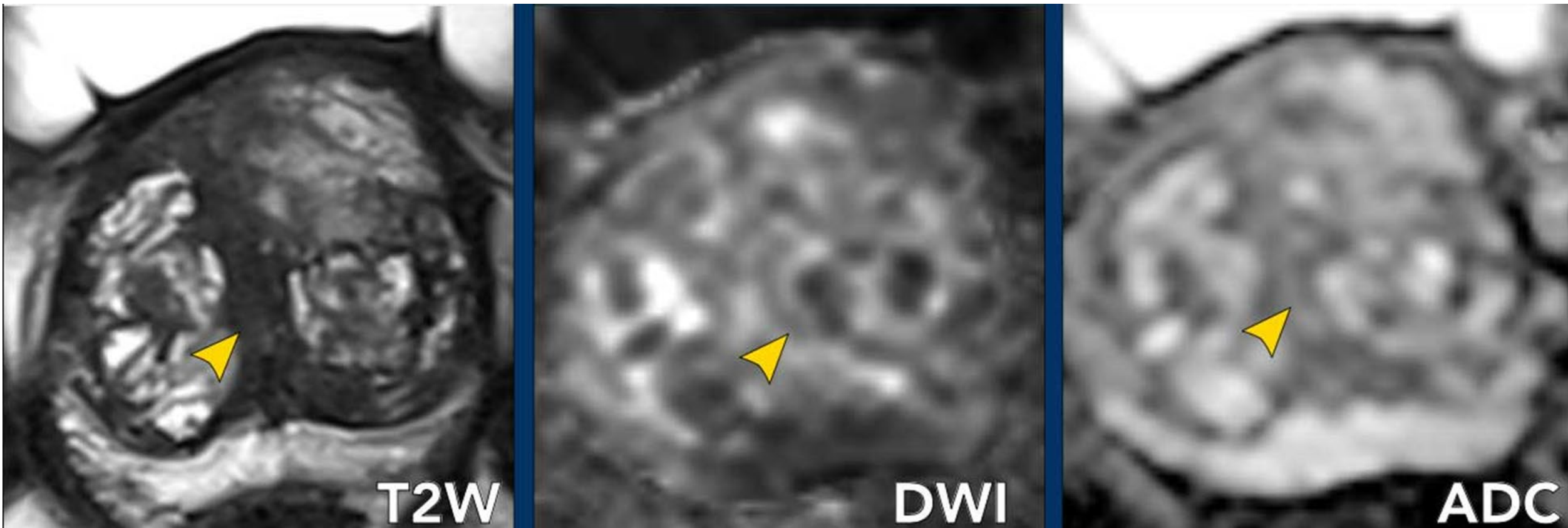
T2W score of 2

1. Mostly encapsulated nodule
2. Homogeneous circumscribed nodule without encapsulation (“**atypical nodule**”)
3. Homogeneous mildly hypointense area between nodules

DWI score 3

- Focal hypo on **ADC** and/or
- Focal hyper on **DWI** or
- Markedly hypo **ADC**
- Markedly hyper on **high -b DWI not both**



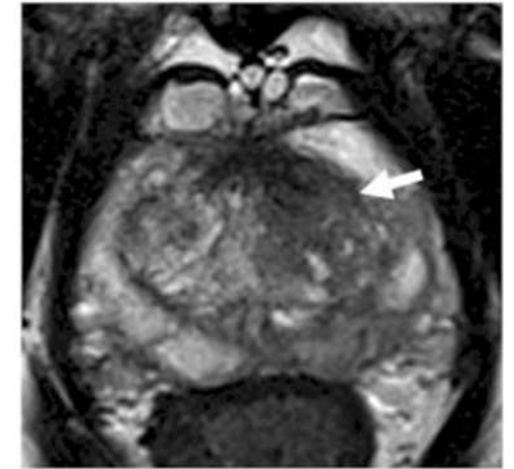
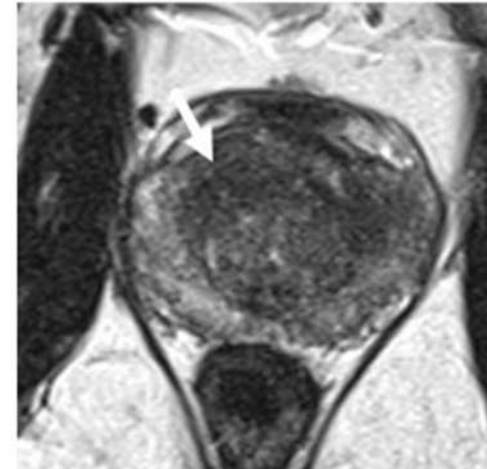
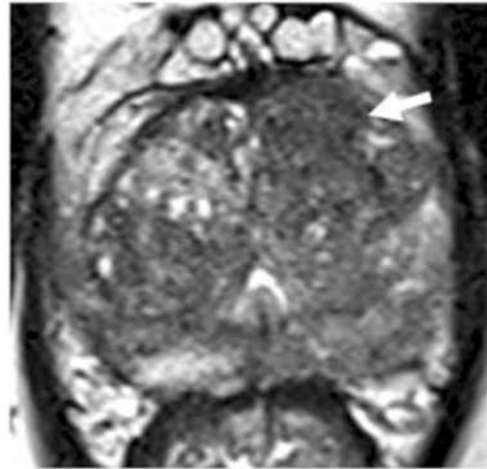
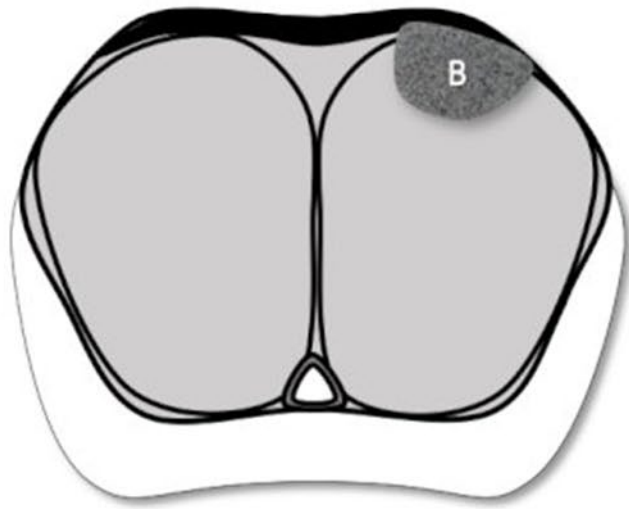
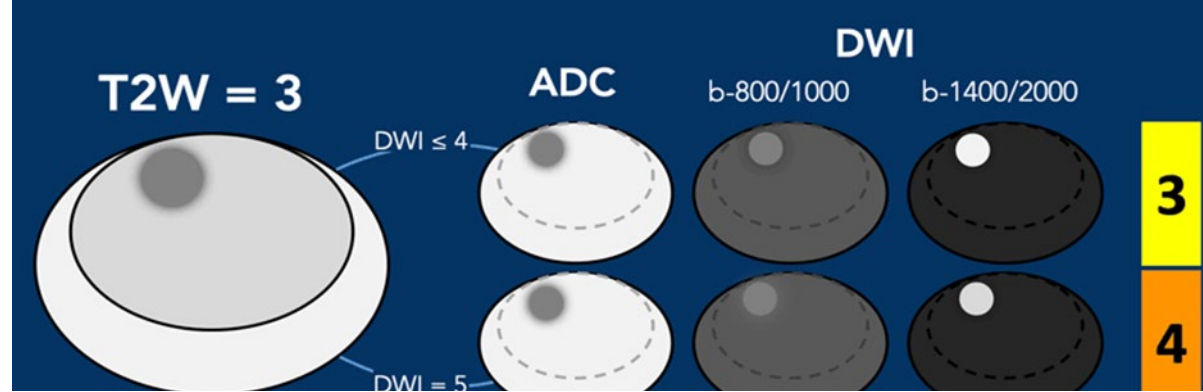


DWI score 2

Linear/wedge hypo **ADC**

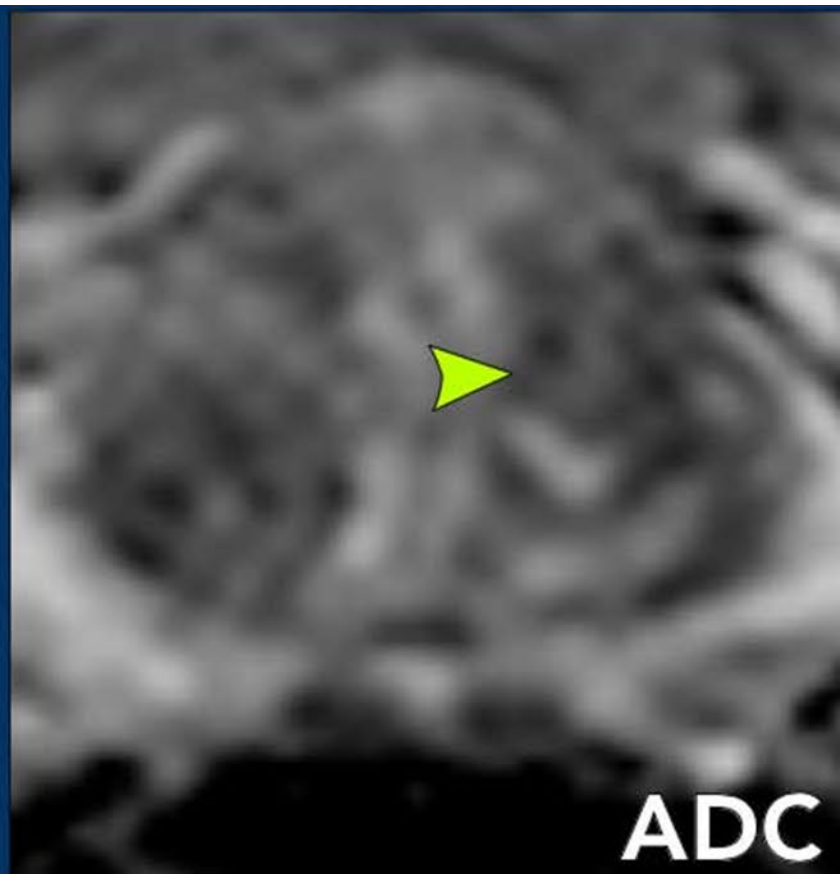
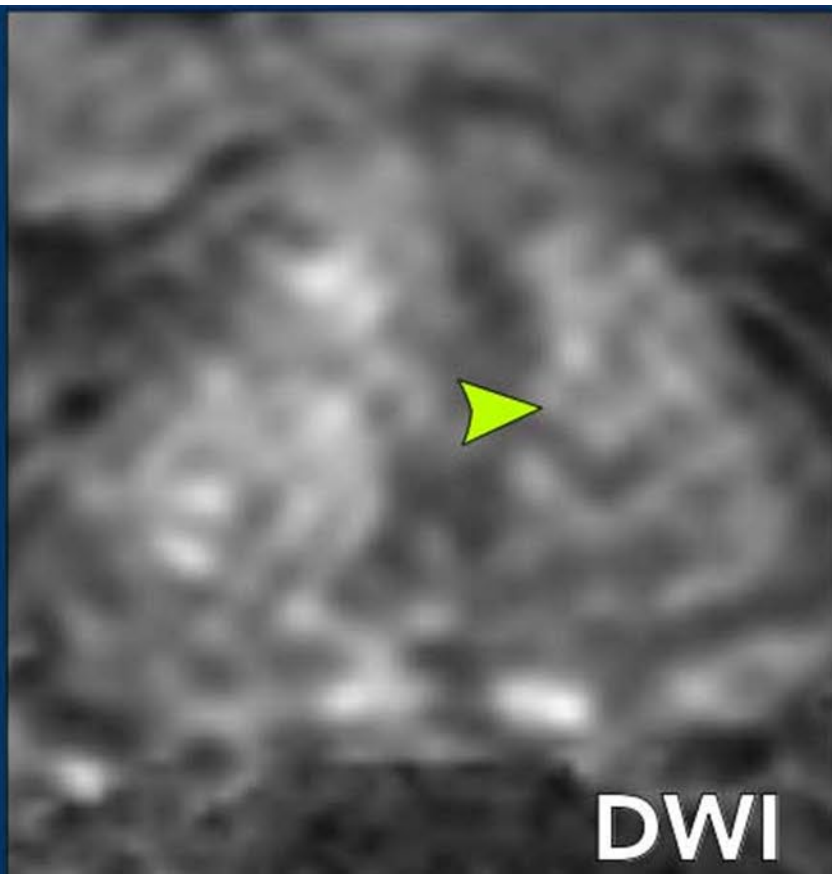
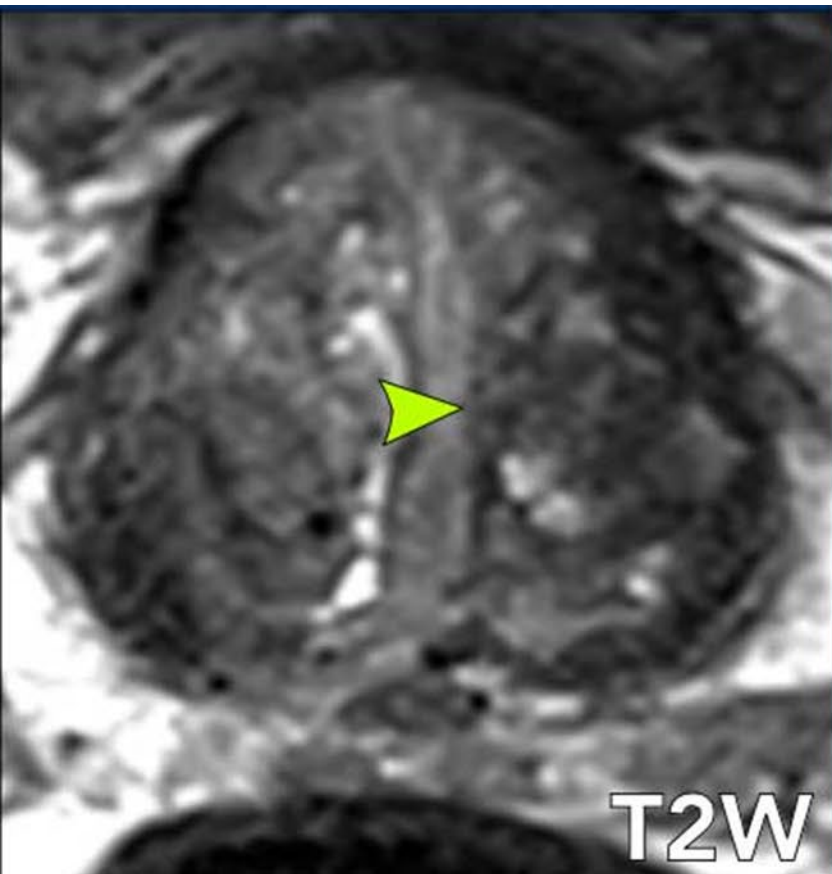
Linear/wedge hyper **high-b DWI**

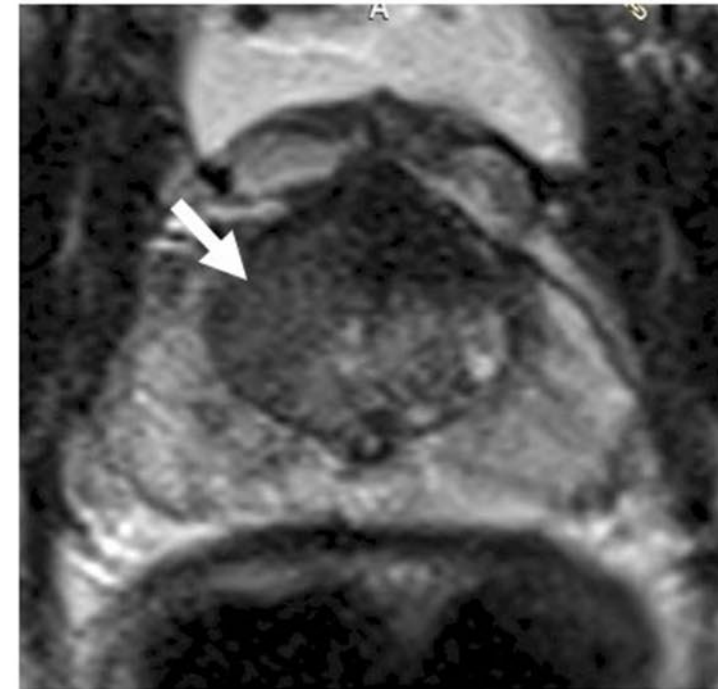
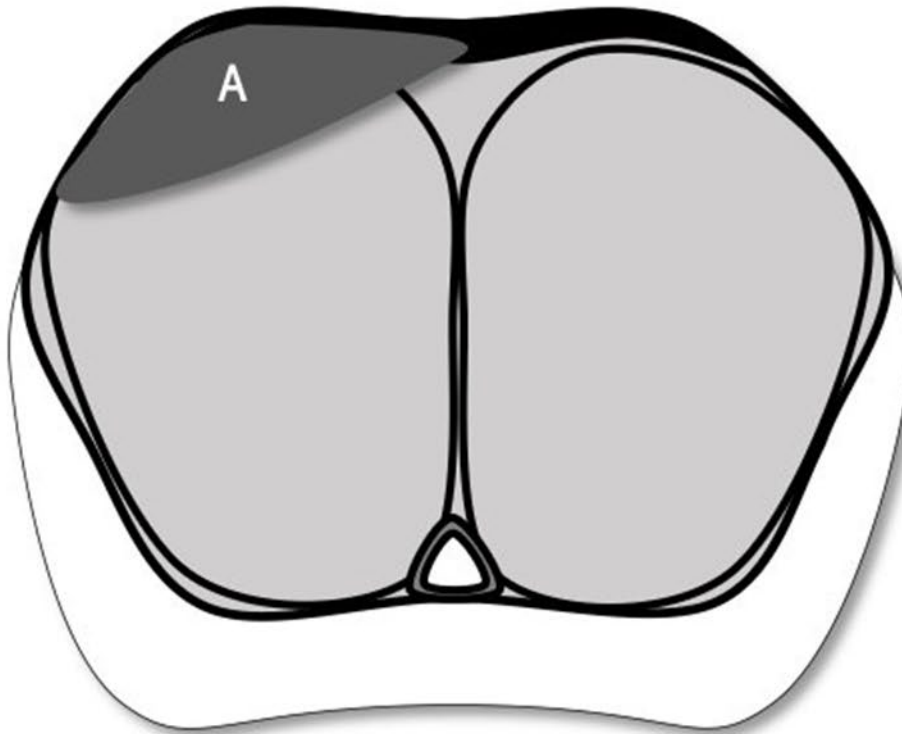
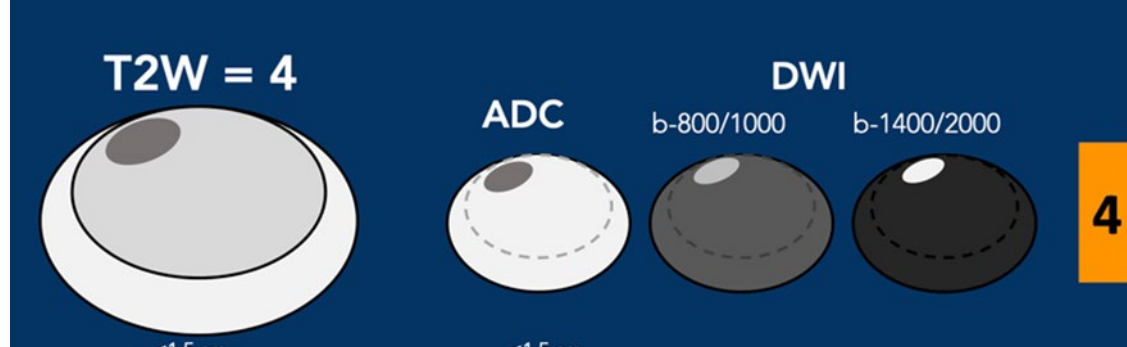




A transition zone T2W score of 3 has heterogeneous signal intensity with **obscured margins** that includes others that do not qualify as 2, 4, or 5



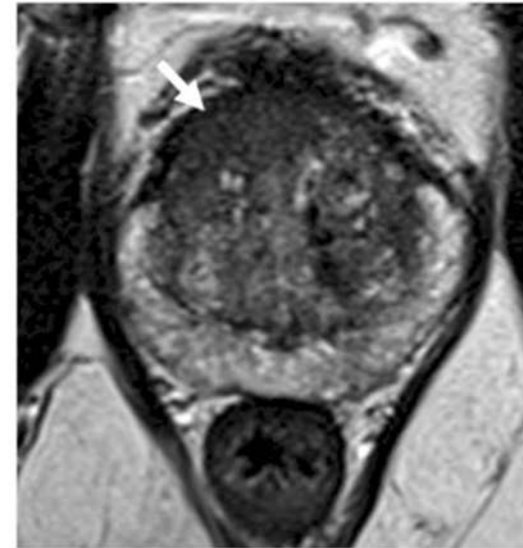
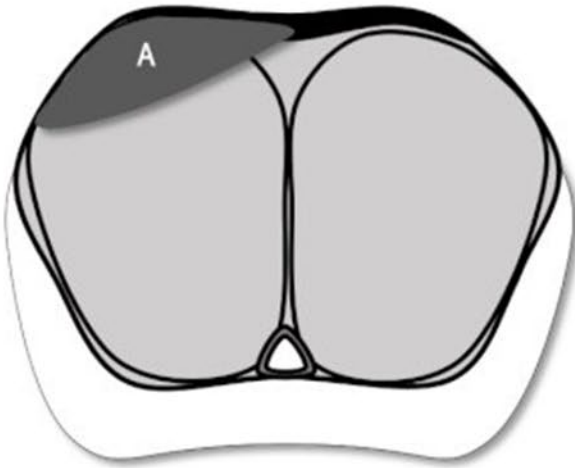
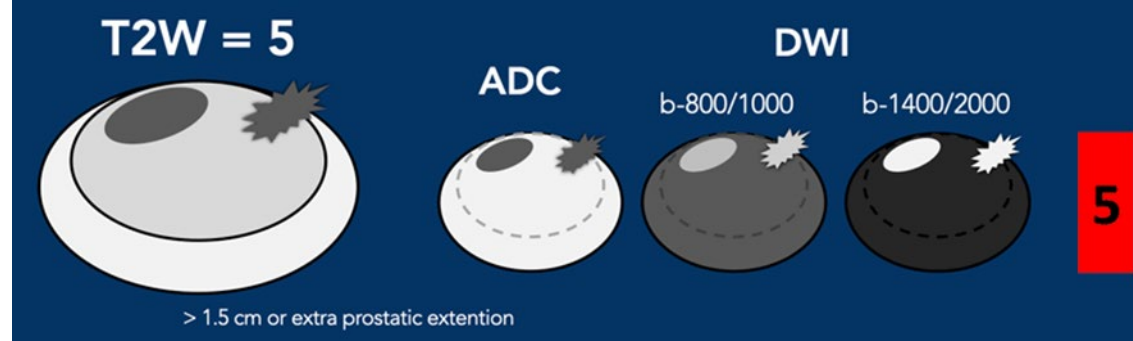




A transition zone T2W score of 4 has lesion that is **lenticular or non-circumscribed**, homogeneous, moderately hypointense, and **<1.5 cm** in greatest dimension

DWI score 4
 Markedly hypo **ADC**
 Markedly hyper **high-b DWI**
 Size **<1.5 cm**

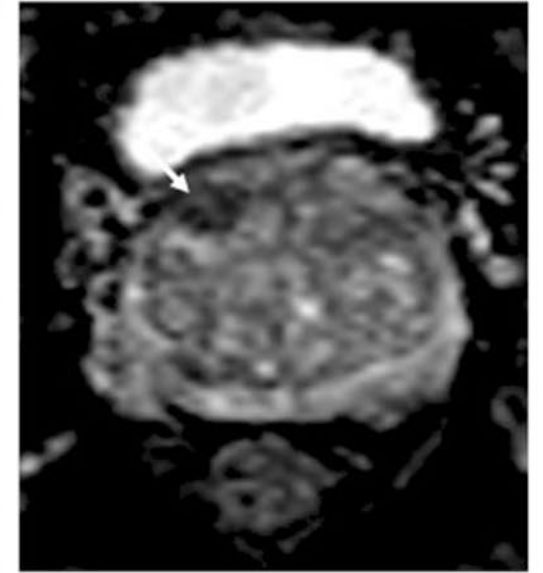
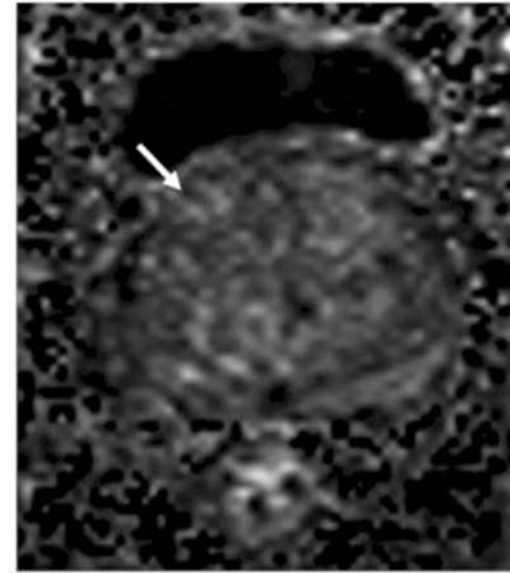
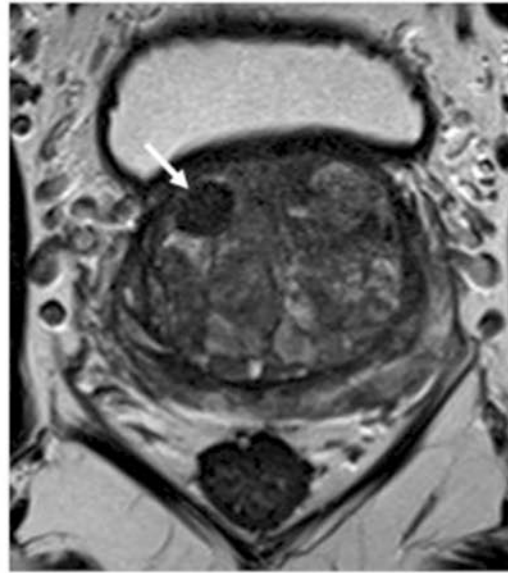
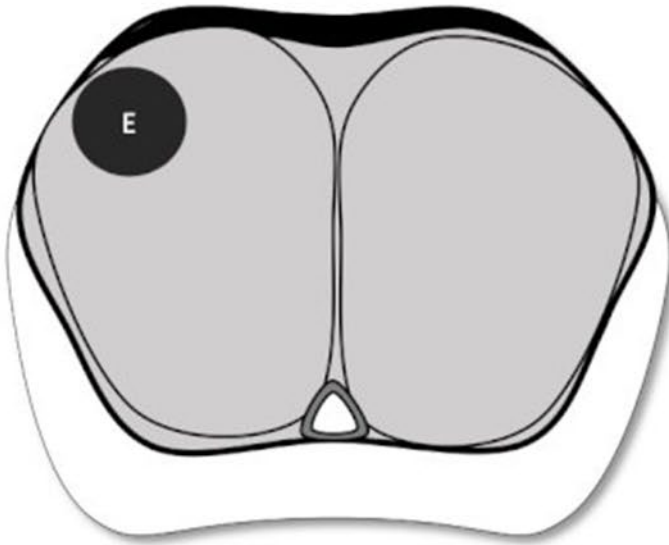




Transition zone T2W score of 5 is the same criteria as for score 4, **but ≥ 1.5 cm** in the greatest dimension or definitive **extraprostatic extension** or invasive behavior

DWI score 5
 Marked restriction
 Size **> 1.5 cm**
EPE





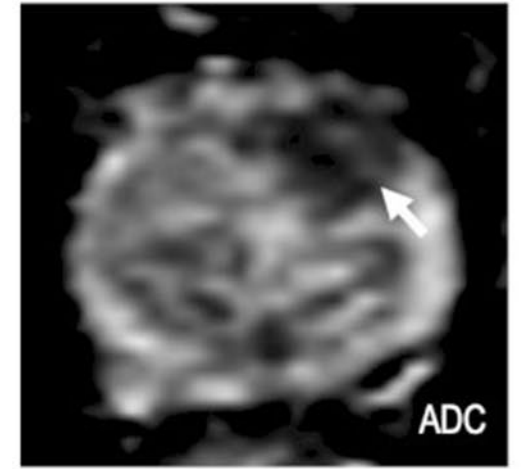
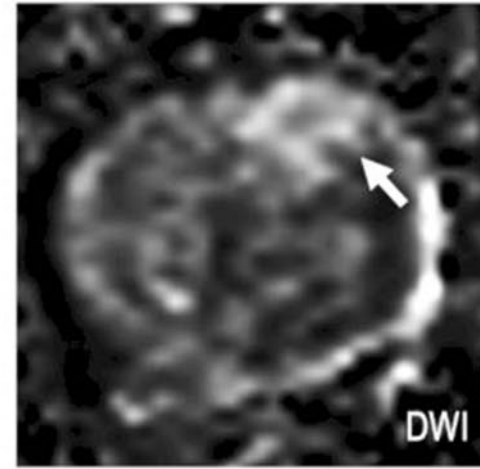
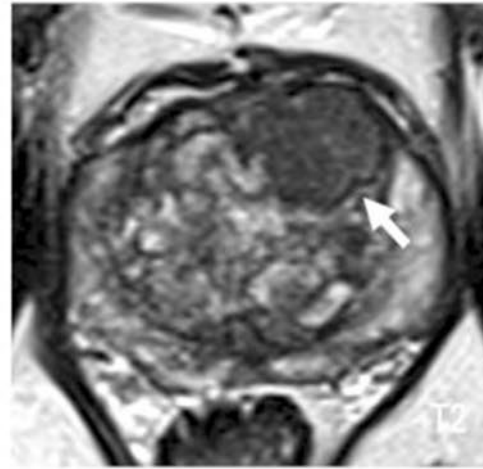
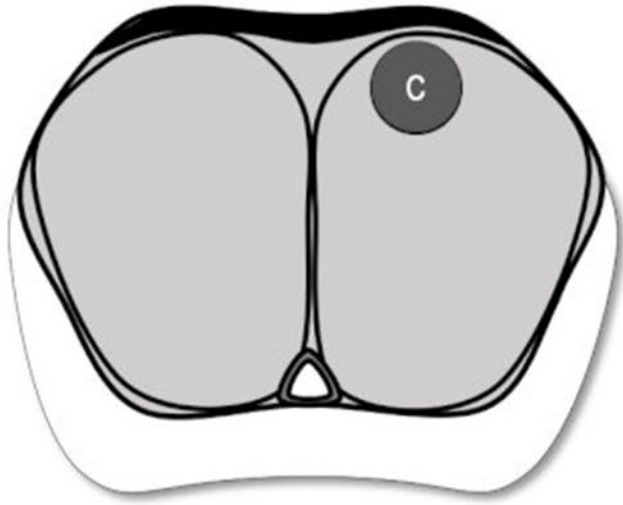
T2 score 2
DWI <4

PIRADS 2

T2 score 2
DWI ≥ 4

PIRADS 3





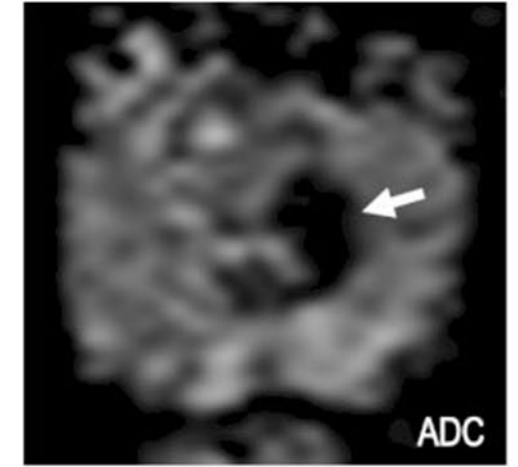
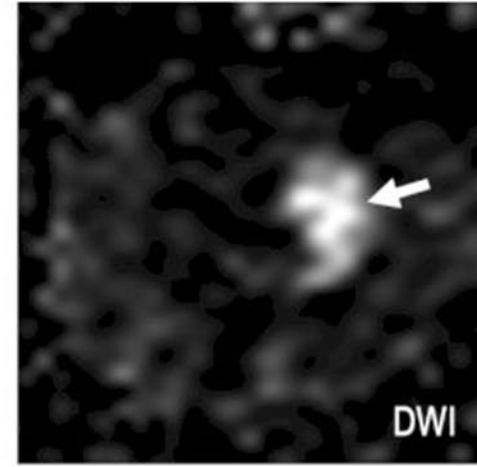
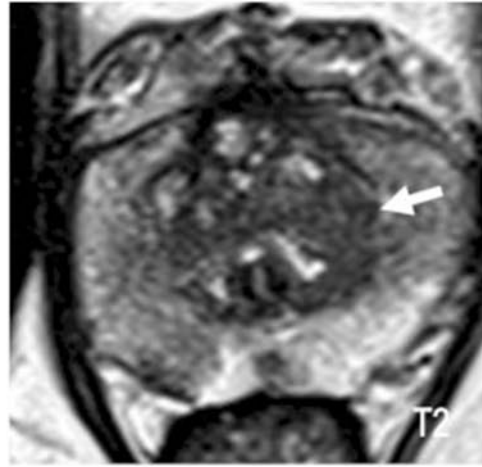
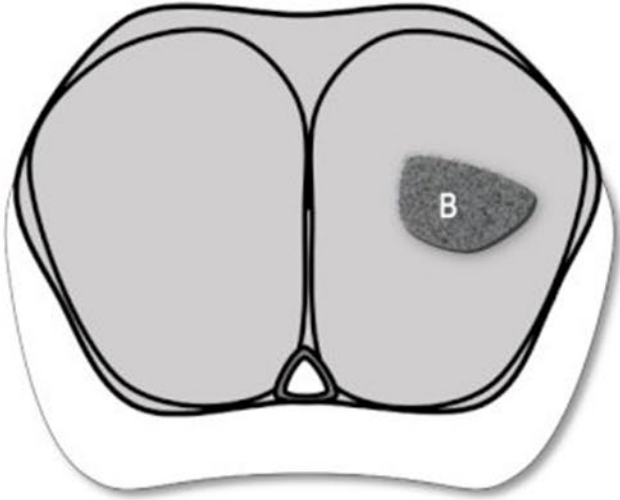
T2 score 3
DWI ≤ 4

PIRADS 3

T2 score 3
DWI = 5

PIRADS 4





T2W score of 3 (heterogeneous signal intensity with obscured margins that do not qualify as 2, 4, or 5)

DWI is <5

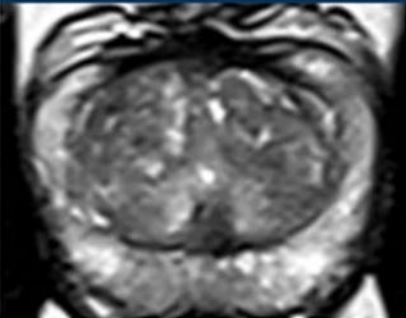
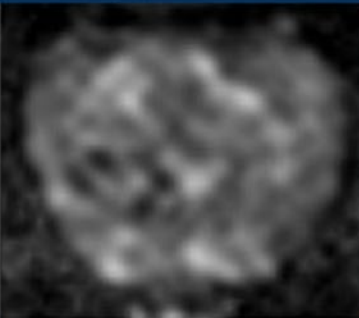
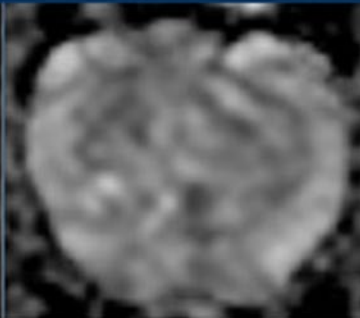
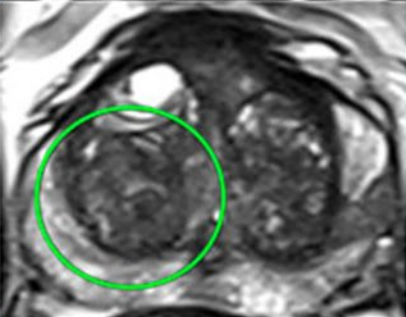
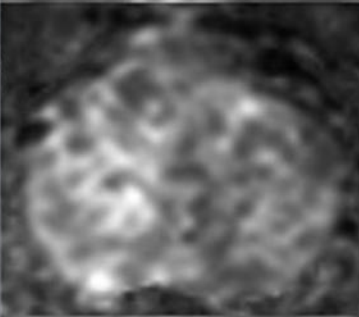
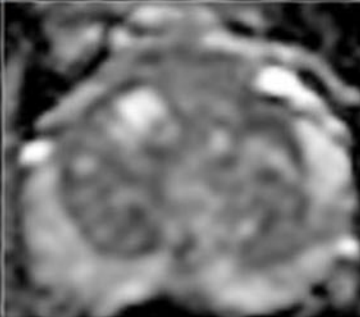
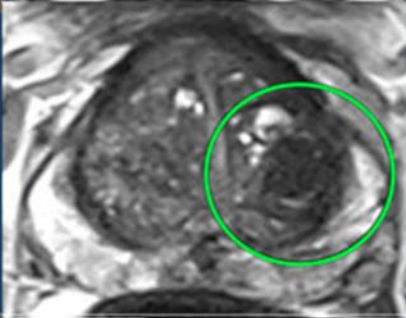
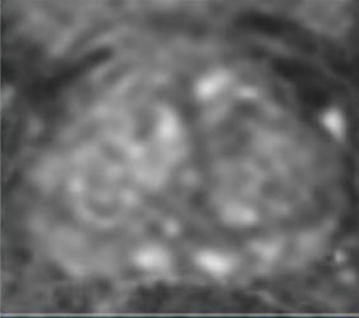
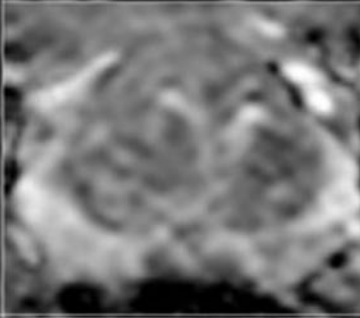
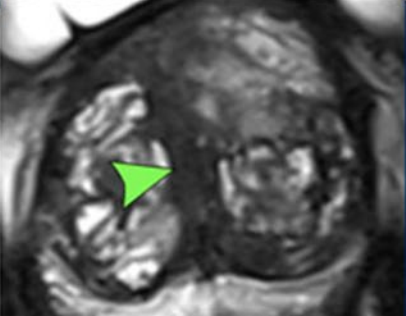
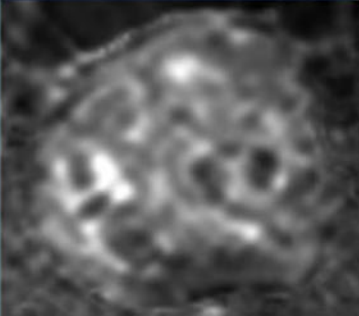
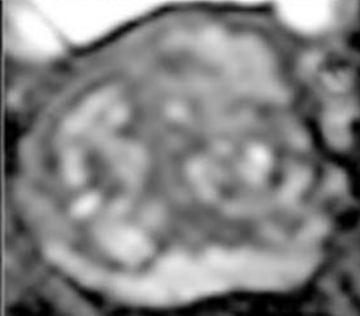
PI-RADS 3

DWI is ≥ 5

PI-RADS 4 (likely clinically significant prostate cancer)



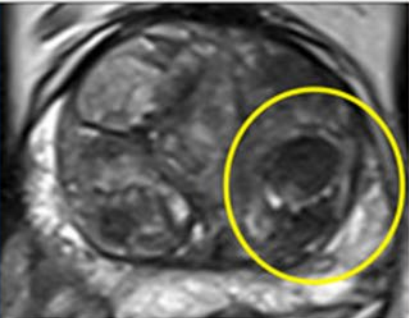
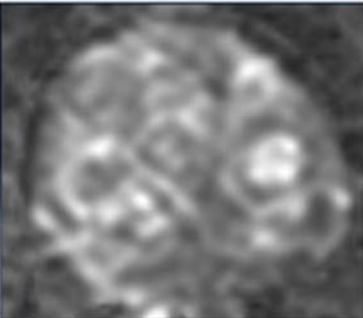
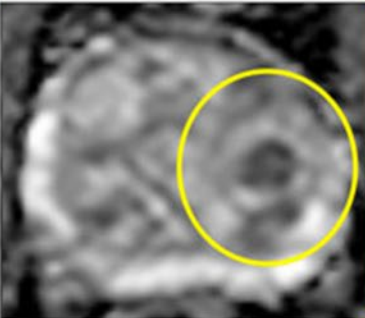
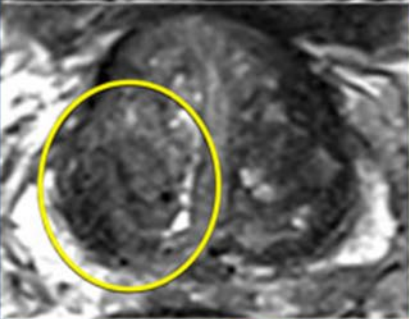
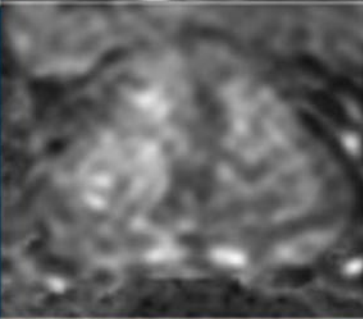
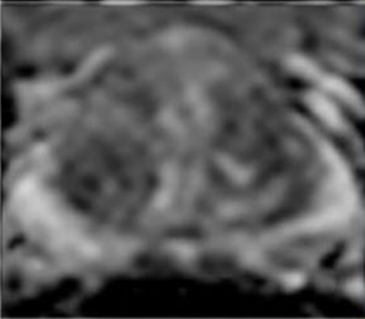
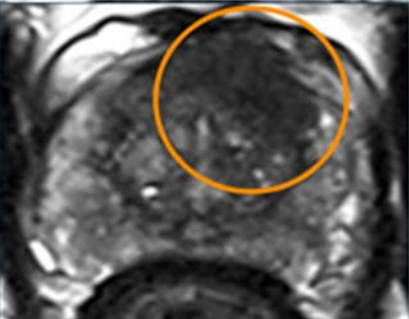
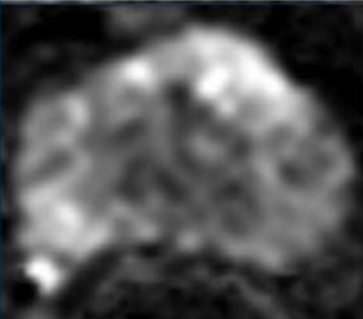
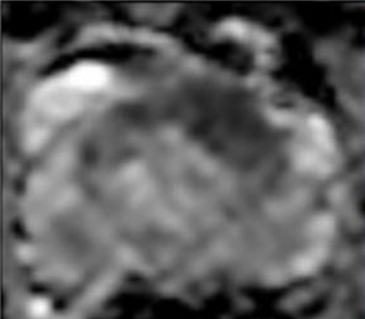
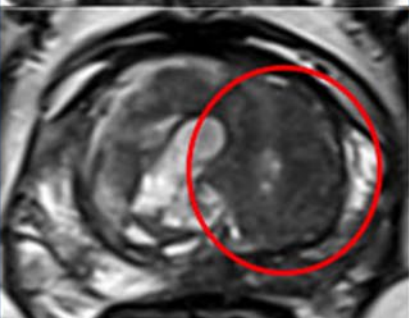
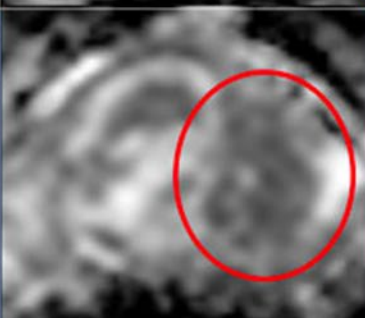
Transition zone

	T2W	DWI	ADC	
Normal appearing TZ (rare) or round, completely encapsulated nodule ("typical")				1
Mostly encapsulated nodule				2
Homogeneous circumscribed nodule without encapsulation. ("atypical nodule")				2
Homogeneous mildly hypointense area between nodules				2

ADC values above 900 mm²/s are considered likely benign and below 750 mm²/s likely malignant.



Transition zone

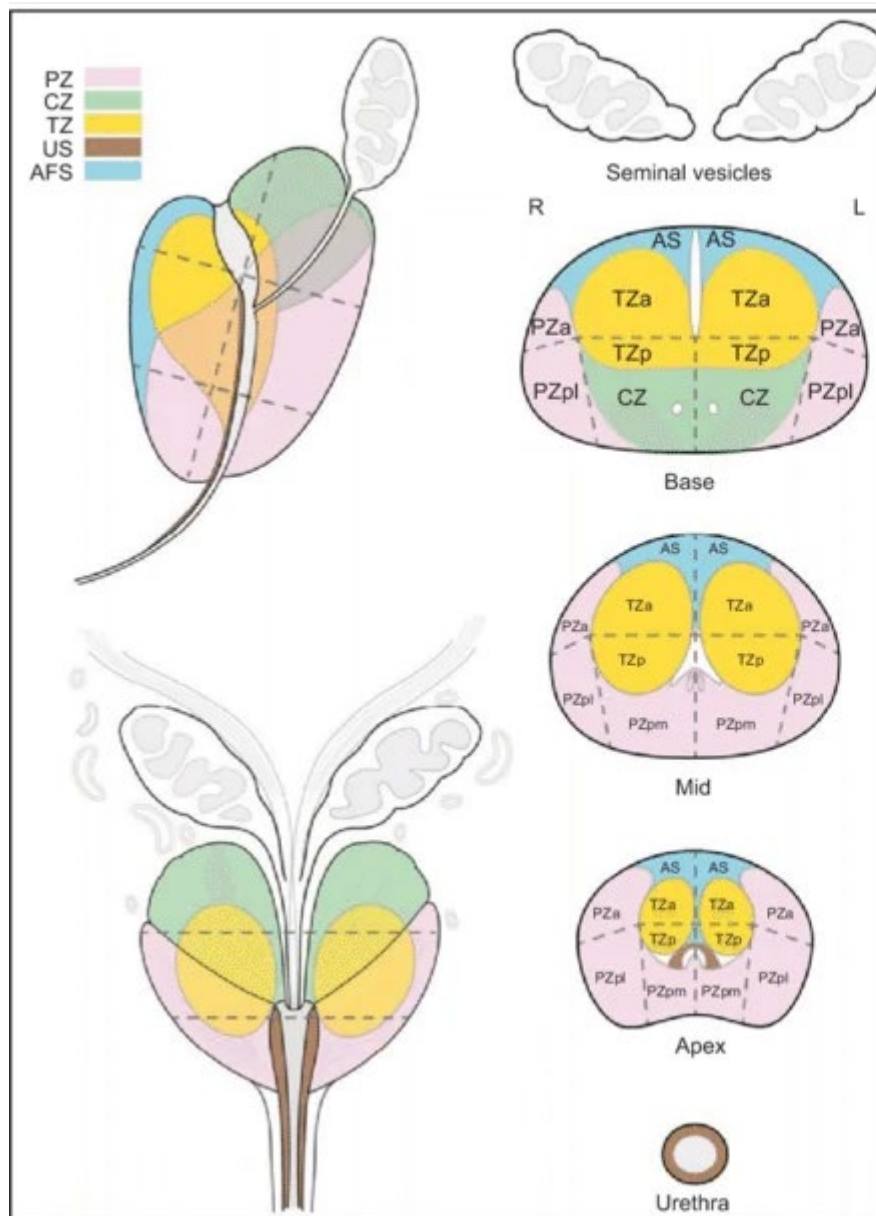
	T2W	DWI	ADC	
Same as PI-RADS 2 but DWI >4				3
Heterogeneous signal intensity with obscured margins (Includes others that do not qualify as 2, 4, or 5)				3
Lenticular or non- circumscribed, homogeneous, moderately hypointense, <1.5cm				4
Same as 4, but ≥1.5cm or definite extraprostatic extension/invasive behavior				5



Peripheral Zone PI-RADS V 2.1 Transition Zone				
ADC / DWI			T2W	
1	Normal	PI-RADS 1	Normal appearing TZ (rare) or round, completely encapsulated nodule	1
2	ADC: Linear/wedge shaped hypointense and/or DWI: linear/wedge shaped hyperintense	PI-RADS 2	Mostly encapsulated nodule or Homogeneous circumscribed nodule without capsule or Homogeneous mildly hypointense area between nodules. DWI ≤ 3	2
3	ADC: Focal hypointense and/or DWI: focal hyperintense May be markedly hypointense on ADC or markedly hyperintense on high b-value DWI, but not both. DCE -	PI-RADS 3	Same as above but DWI ≥ 4	2
3	Same as above but DCE +		Heterogeneous signal intensity with obscured margins. Includes others that do not qualify as 2, 4, or 5. DWI ≤ 4	3
3	Same as above but DCE +		Same as above but DWI = 5	3
4	ADC: Focal markedly hypointense DWI: markedly hyperintense Diameter < 1.5cm	PI-RADS 4	Lenticular or non-circumscribed, homogeneous, moderately hypointense, < 1.5cm. any DWI	4
5	Same as 4, but ≥ 1.5cm or extraprostatic extension	PI-RADS 5	Same as 4, but ≥ 1.5cm or extraprostatic extension. any DWI	5



A



B

Transition zone			
T2W	DWI	DCE	Pirades
1	Any	Any	1
2	Any	Any	2
3	≤4	Any	3
	5	Any	4
4	Any	Any	4
5	Any	Any	5

Peripheral zone			
DWI	T2W	DCE	PIRADS
1	Any	Any	1
2	Any	Any	2
3	Any	–	3
		+	4
4	Any	Any	4
5	Any	Any	5



Suspicious lesions in T2

Non-circumscribed

Homogeneous hypo

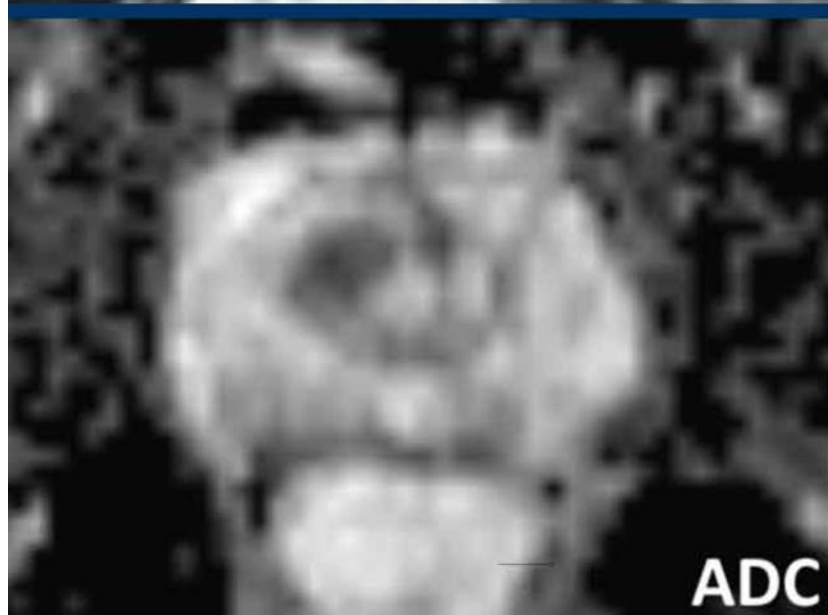
Smudged appearance on T2W images (erased charcoal appearance).

Lenticular or droplet-like shape

Spiculated margins.

Suspicious lesions in the transition zone are frequently challenging to distinguish from the surrounding hyperintense glandular and hypointense stromal tissue.

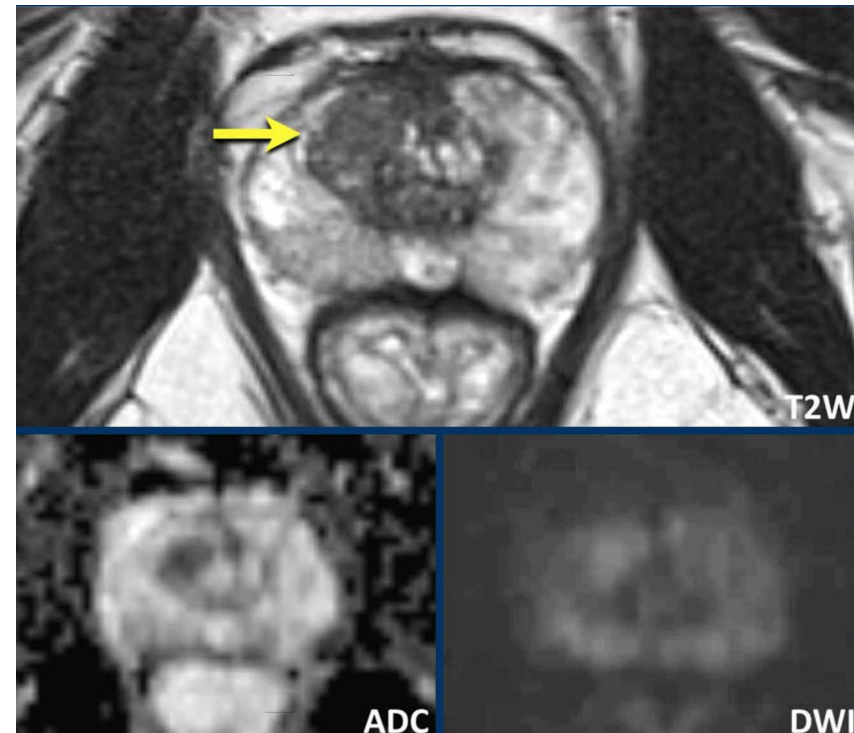


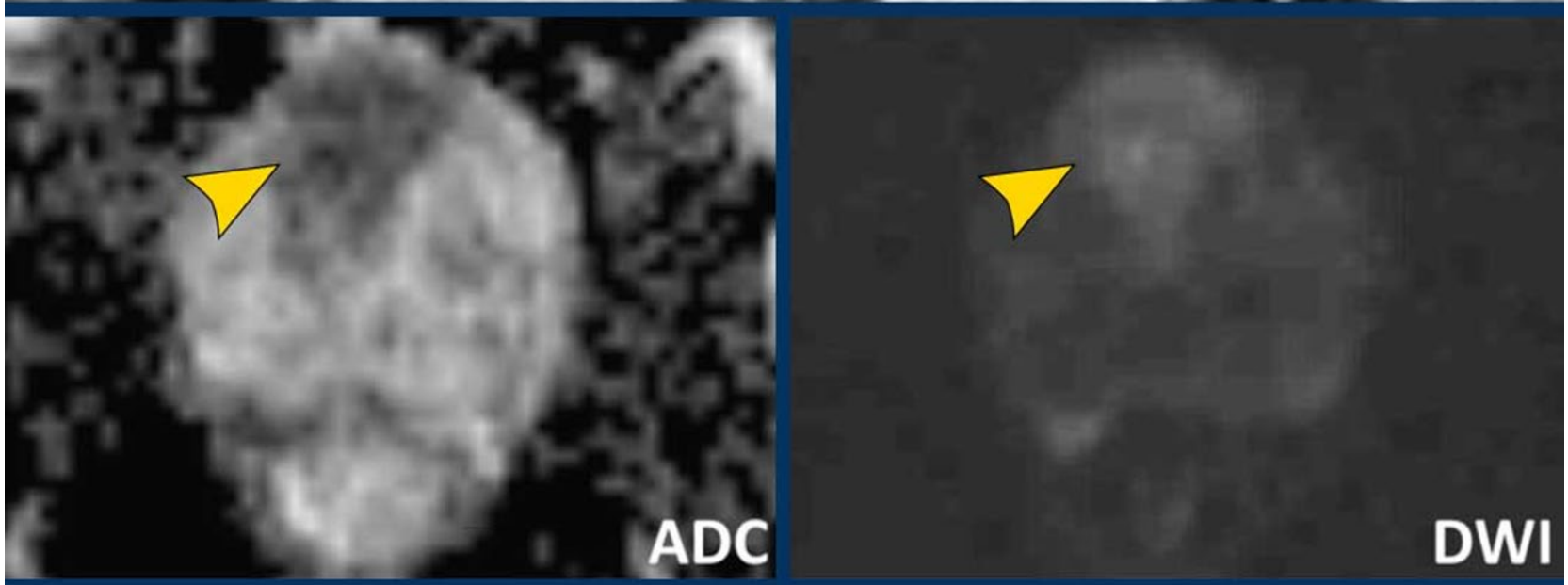


REPORT

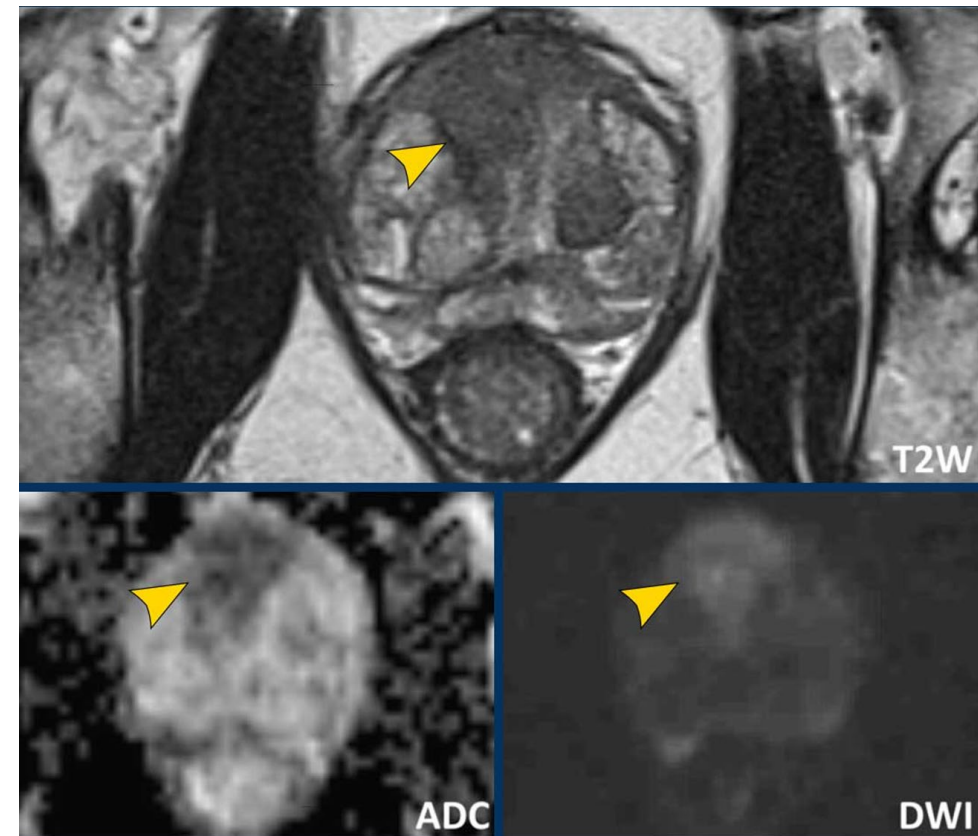
- **T2** score 4 irregular margin RtTZa
- Size < 15 mm
- **ADC** score 4
- **PIRADS 4**
- MR-US guided fusion Bx **G 3+4**

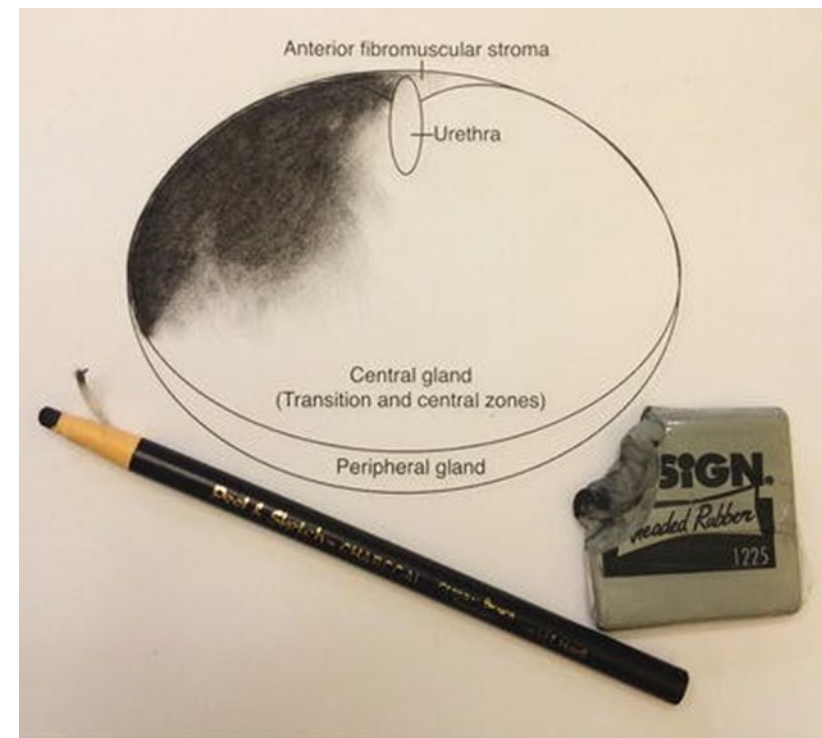
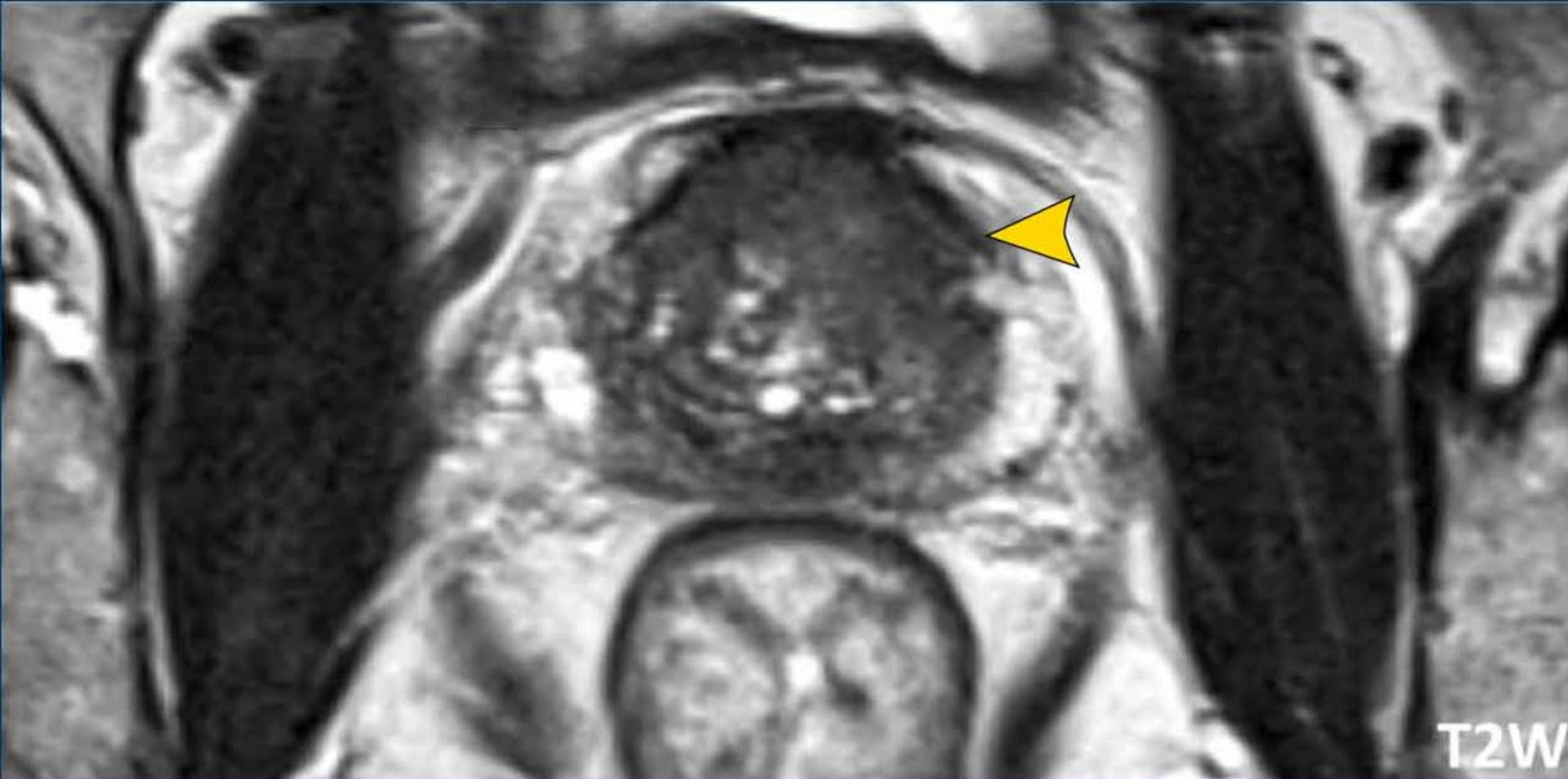
- T2 score 2 wedge slightly hypo RTPZpm
- ADC score 2
- PIRADS 2



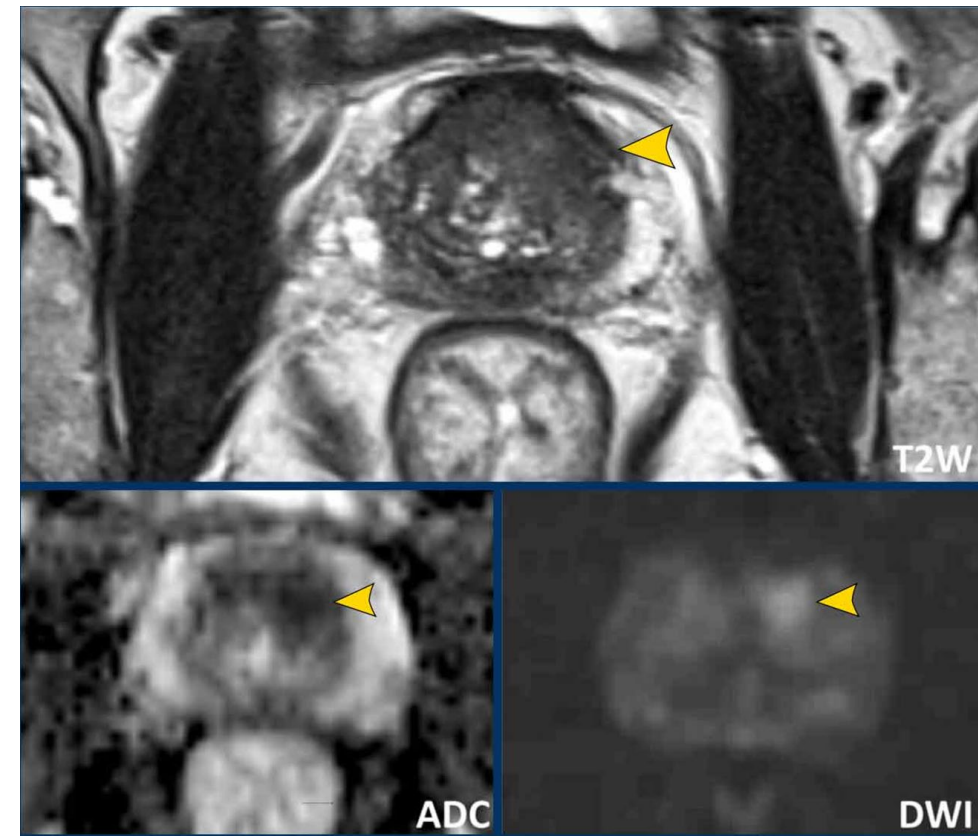


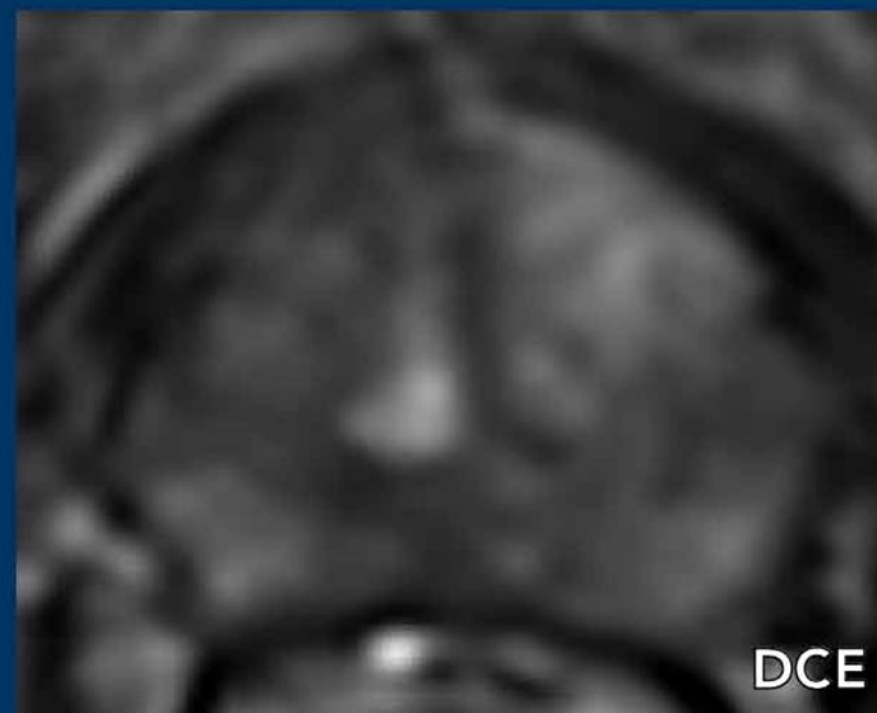
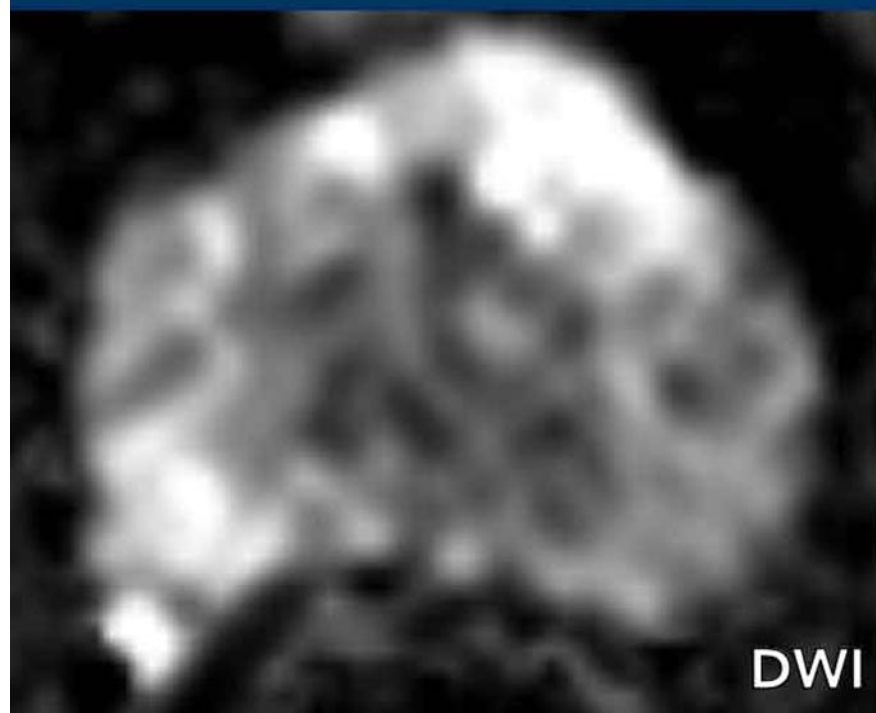
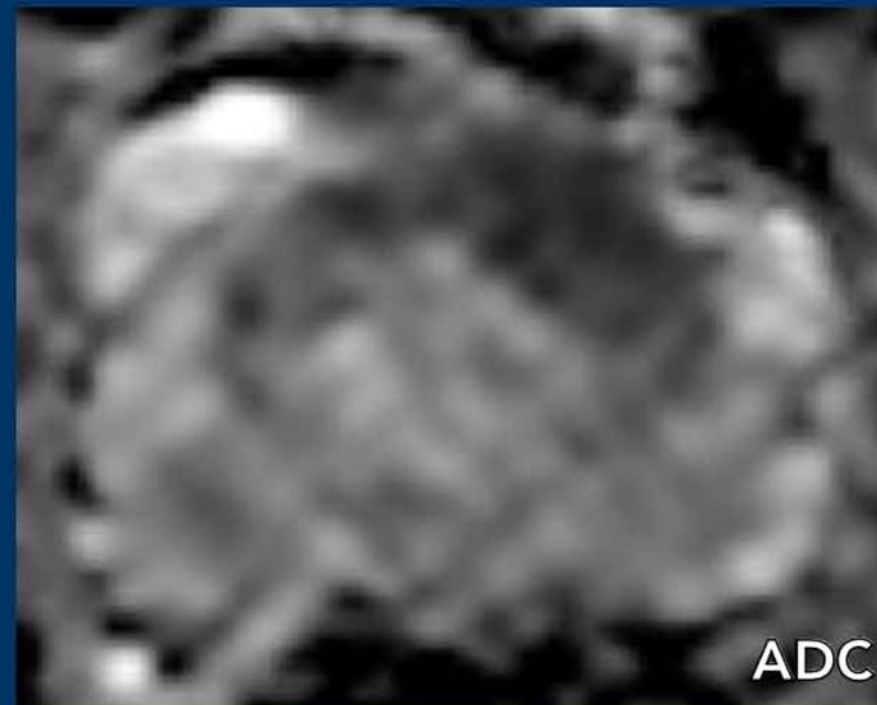
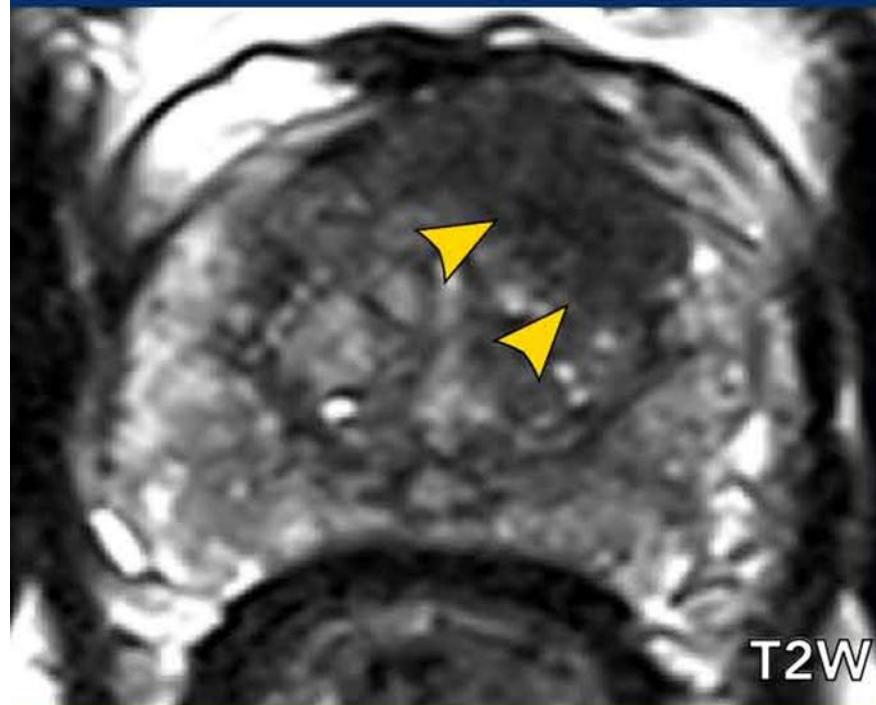
- **T2** AFMS junction of base and mid
- Irregular margin **erased charcoal**
- Size > 15 mm
- **ADC score 5**
- **PIRADS 5**
- G 3+4



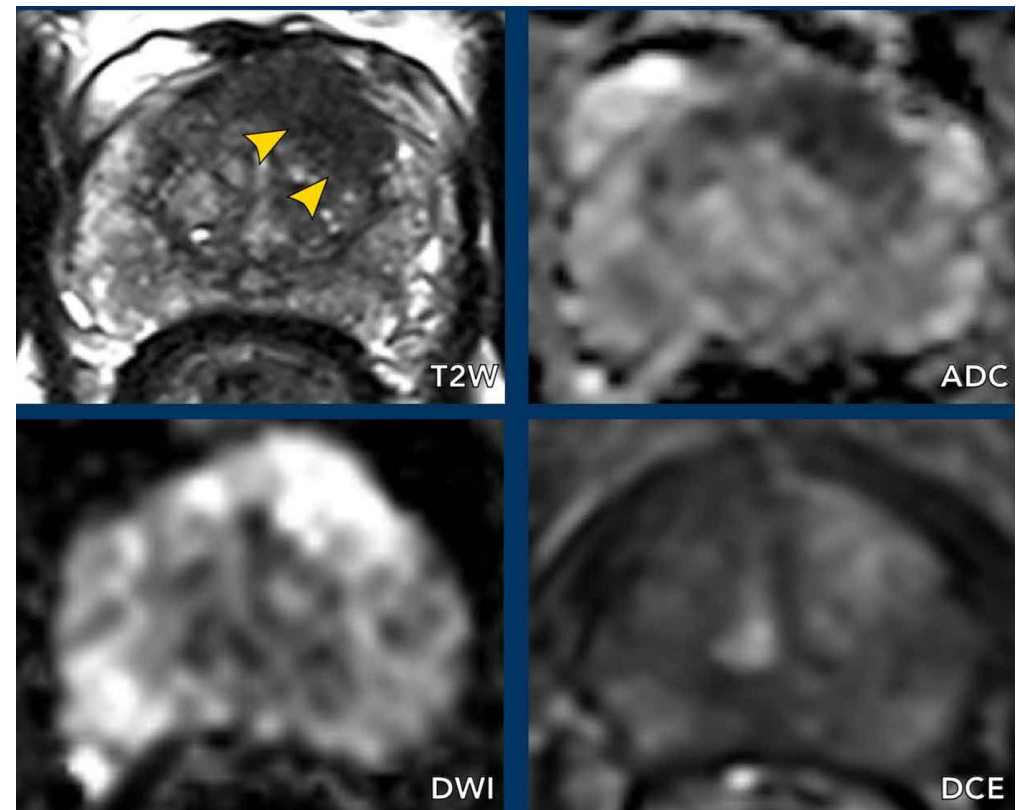


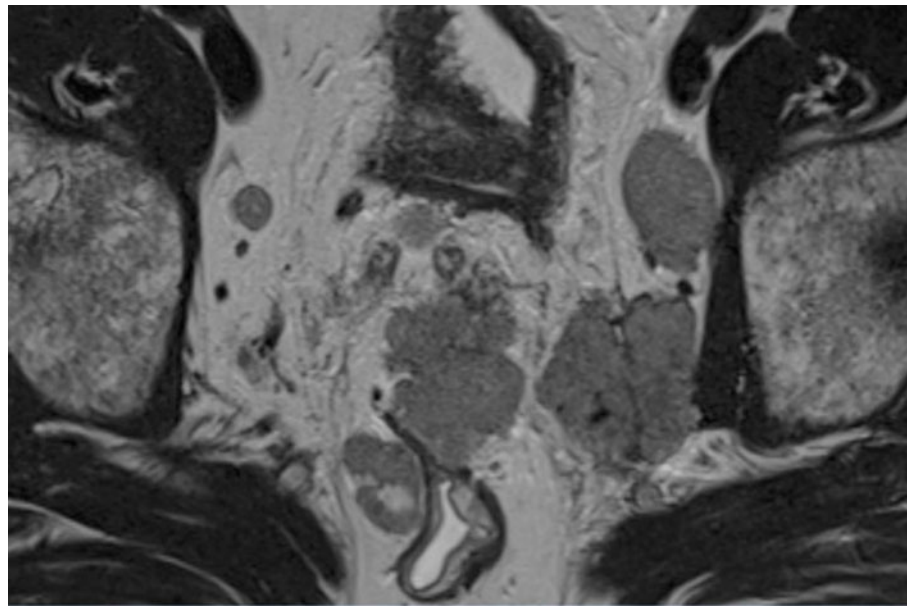
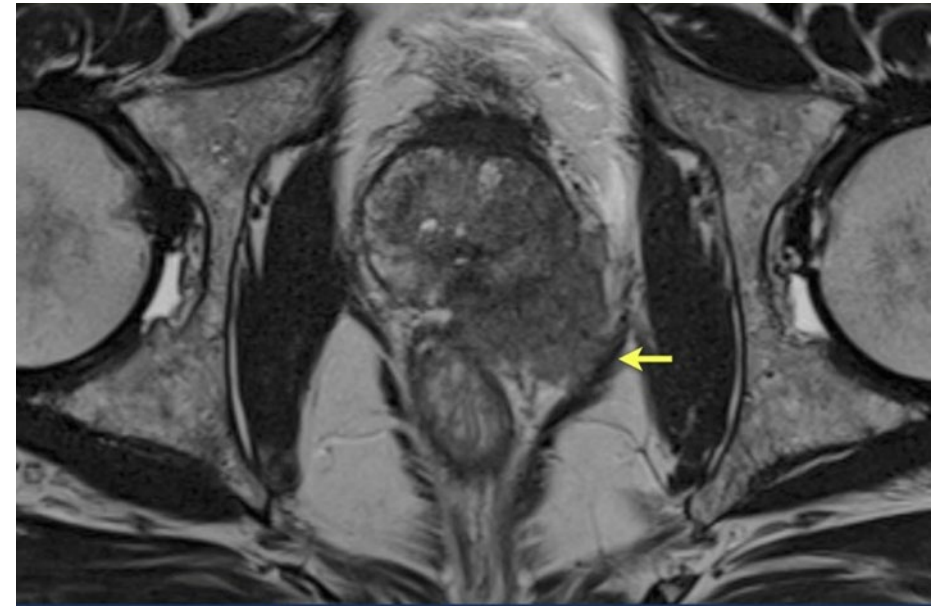
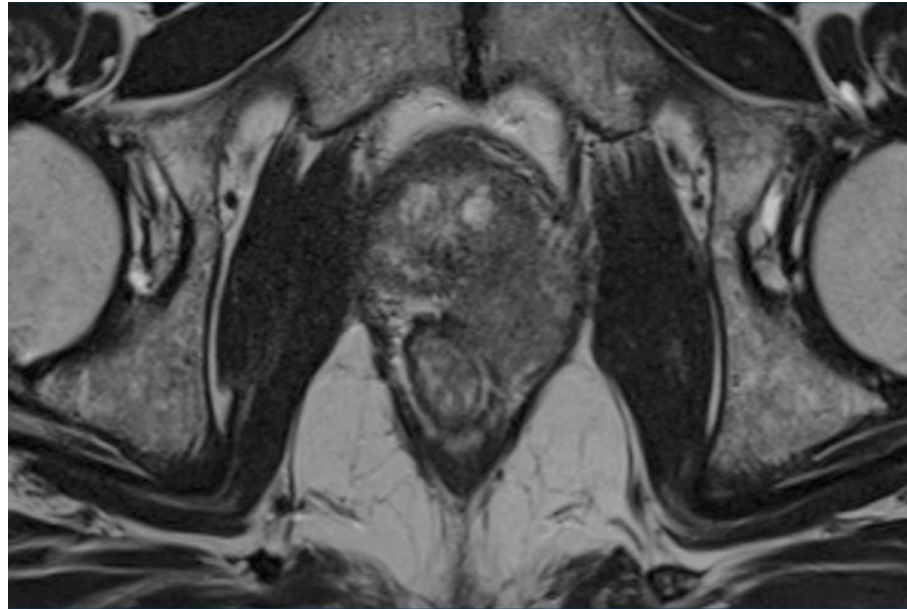
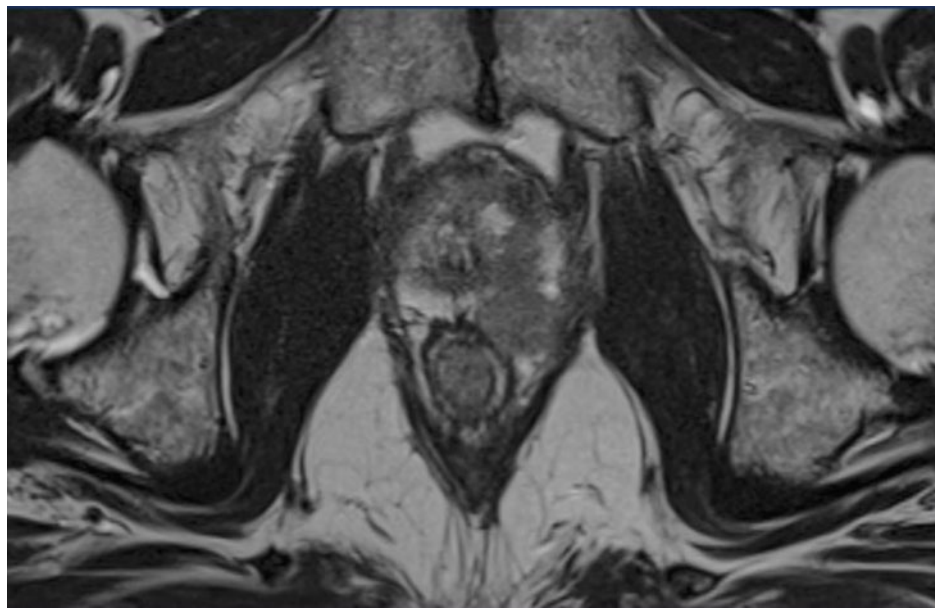
- **T2** erased charcoal Apex T2a score 5
- Size 27 mm
- **ADC/DWI** droplet shape
- **PIRADS 5**
- G 3+4





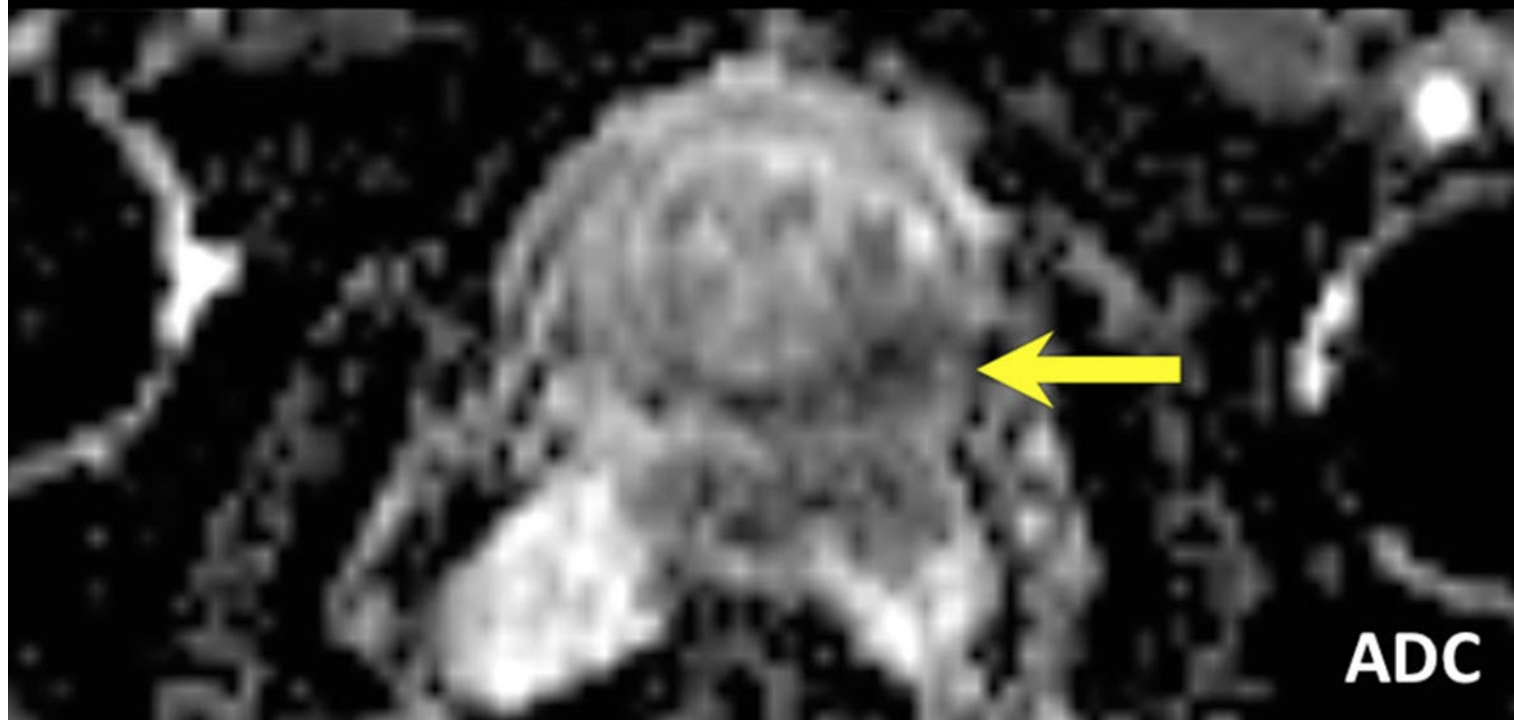
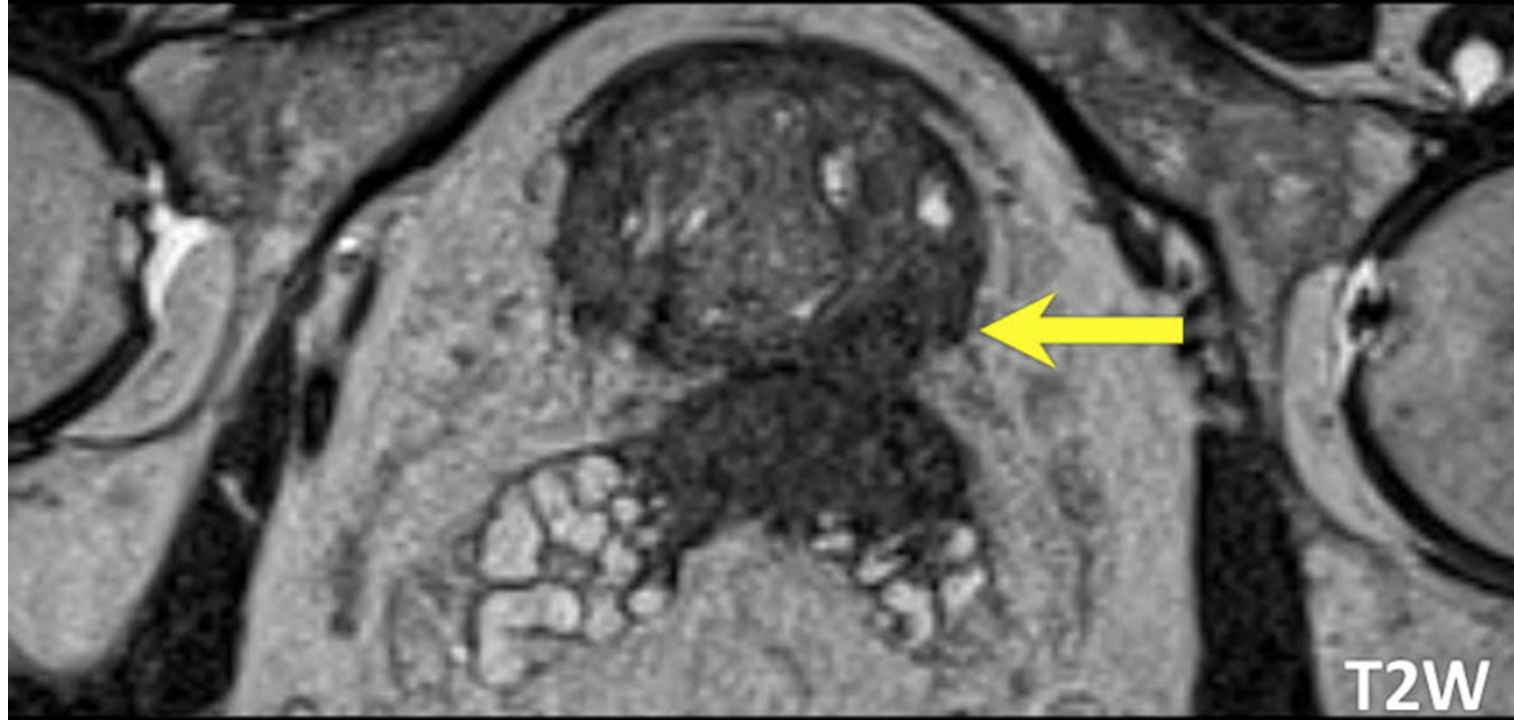
- **T2** lenticular score 4 Lt Tza
- **ADC/DWI** score 4
- **DCE** *early focal enhancement*
- **PIRADS 4**
- **G 4+4**
- *Involving AFMS*





Involvement of the **neurovascular bundle** should be specifically reported, as **nerve-sparing surgery** will not be possible.





Prostate Cancer Staging

T1	Clinically inapparent tumor neither palpable nor visible by staging T1c = Tumor identified by needle biopsy
T2	Tumor confined within prostate. Invasion into the prostatic apex or into (but not beyond) the prostatic capsule is classified not as T3 but as T2
T3	Tumor extends through the prostate capsule T3a = Extracapsular extension T3b = Invasion seminal vesicles
T4	Tumor is fixed or invades adjacent structures External sphincter, rectum, bladder, levator muscles, and pelvic wall
N1	Metastasis in regional lymph nodes
M1	Distant metastasis M1a = Nonregional lymph nodes M1b = Bones M1c = Others



1.The vascular insertion at both the base and apex are susceptible locations for extraprostatic extension.

2.Seminal vesicle invasion can be observed by direct tumor extension into the vesicles.

3.Expansion of the vesicles, focal or diffuse low T2W signal intensity, abnormal contrast enhancement or restricted diffusion can also be features of involvement.

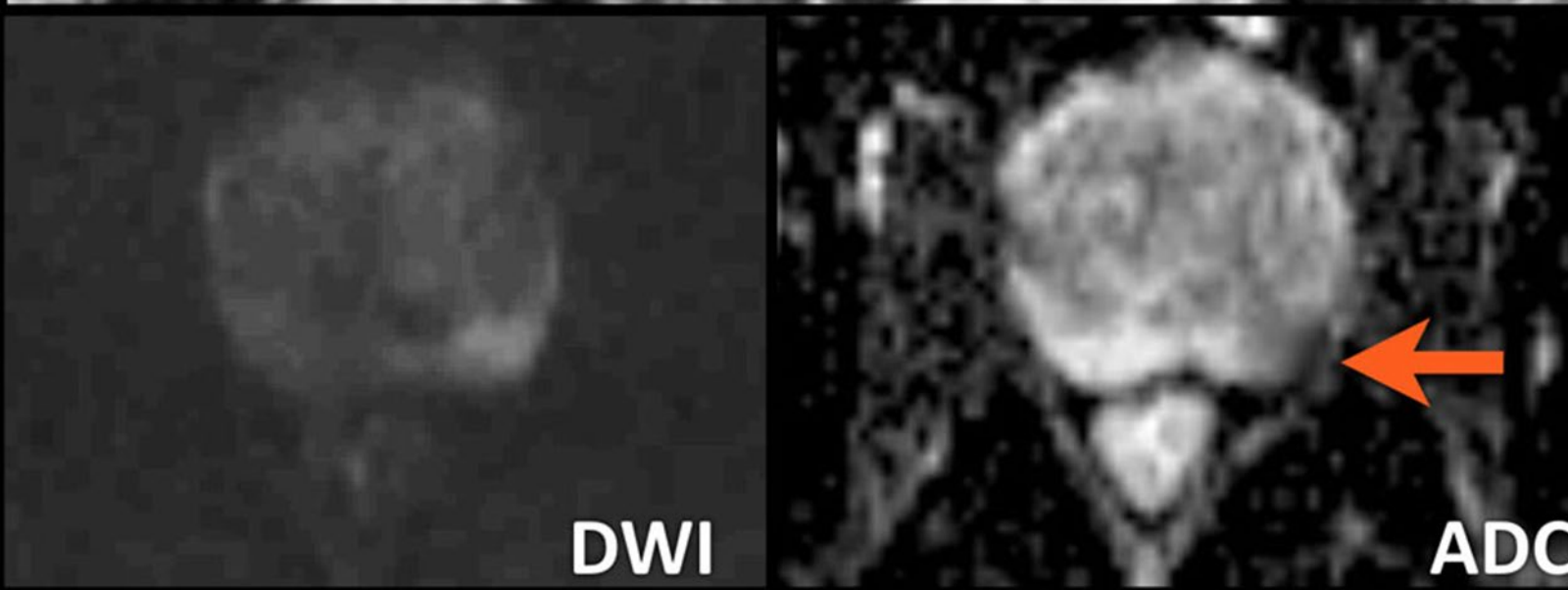
4.In addition, involvement is likely present when the **angle between the prostate base and the vesicle is obliterated.**

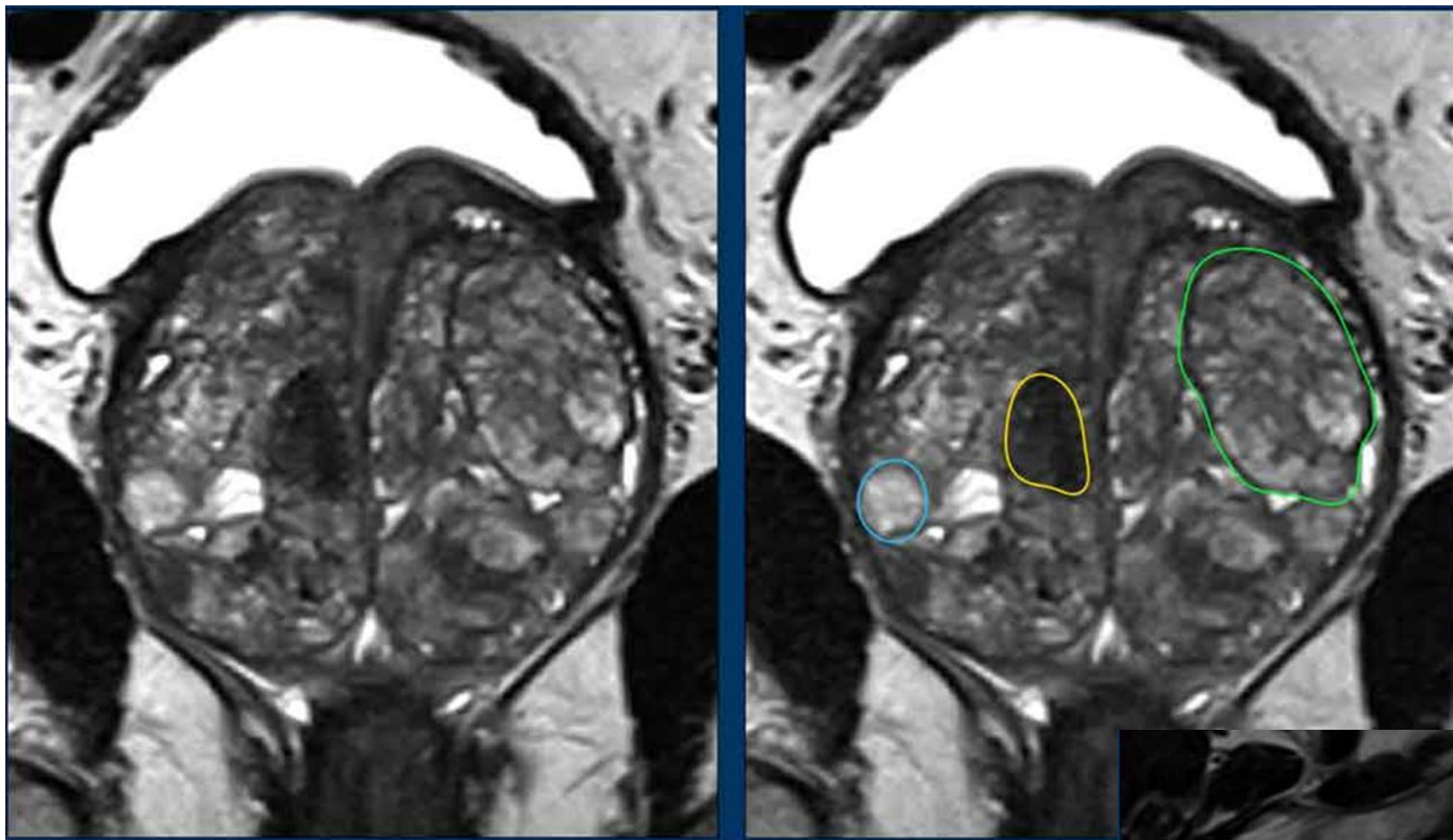
5.When the **external urethra is involved at the apex, surgical excision can cause sphincter malfunction, resulting in incontinence.**



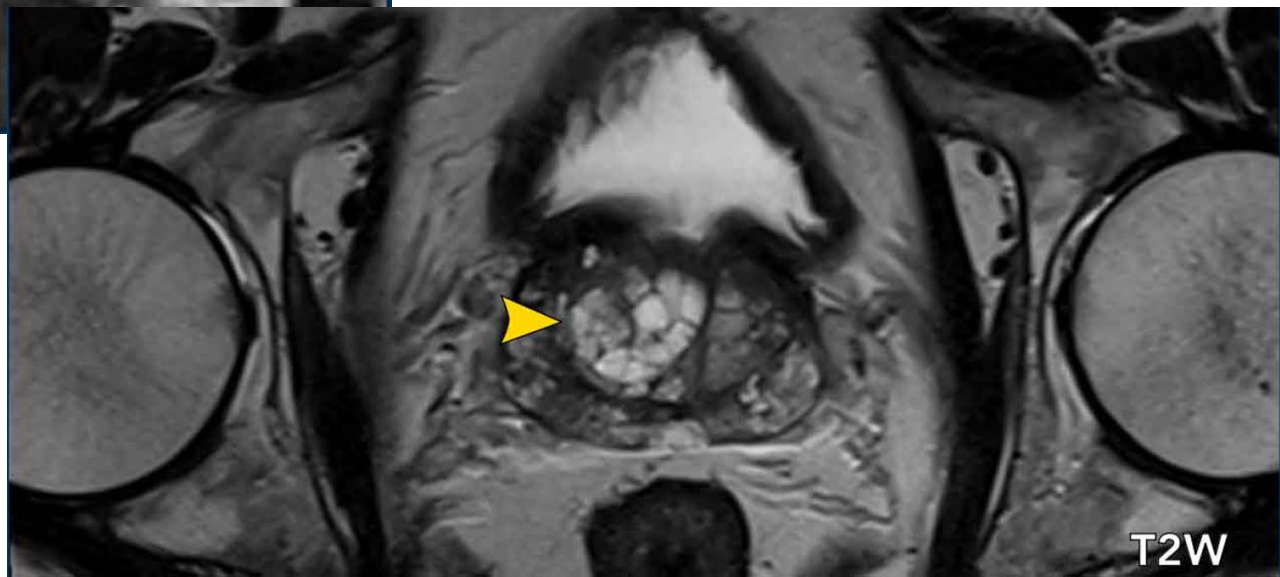


T2 hypointense BPH nodules can be less distinctly circumscribed within the transition zone and may show some degree of restricted diffusion. Also, these nodules tend to enhance early and intensely on DCE, making conclusive characterization difficult.



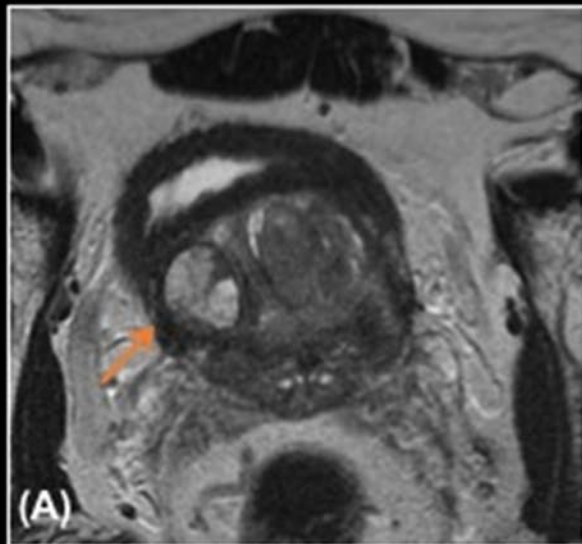


glandular nodule
atypical nodule
nodule in nodule



NON-CANCEROUS ABNORMALITIES

BENIGN PROSTATIC HYPERPLASIA

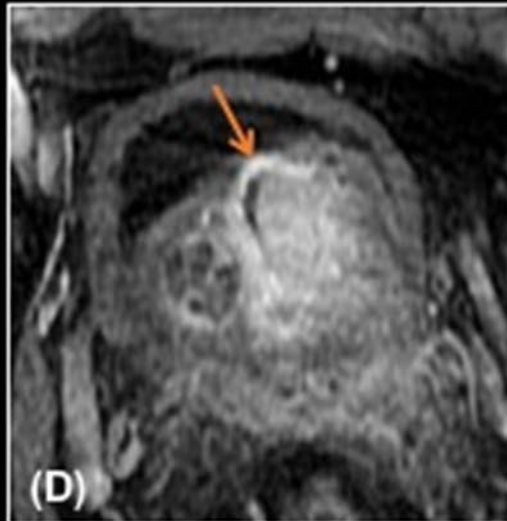
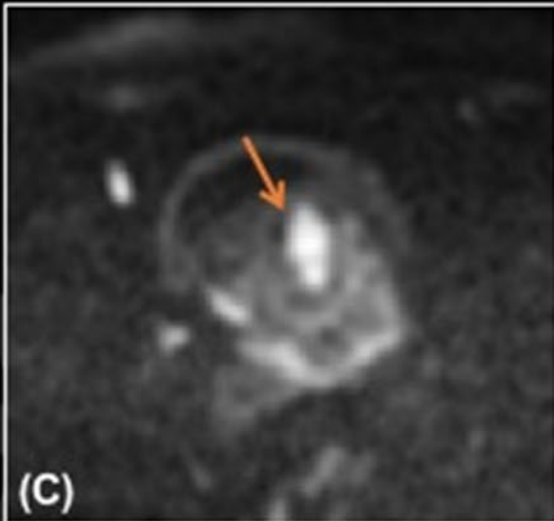
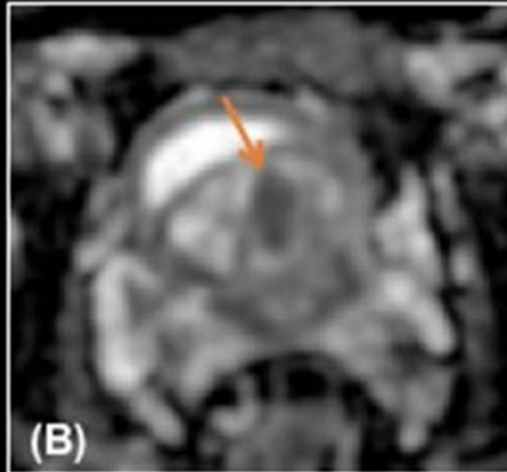
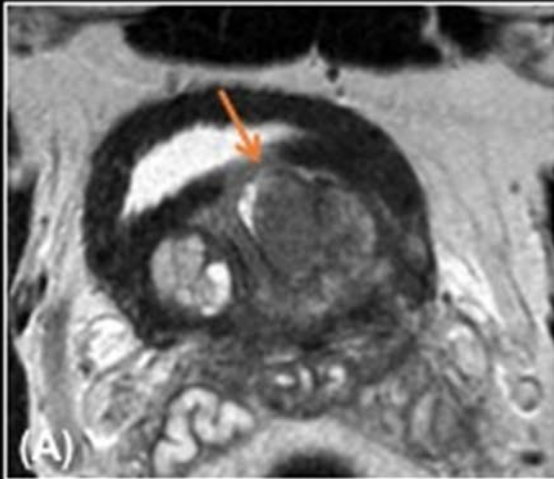


(A). Axial (B) Coronal, and (C) Sagittal, T2WI fast spin-echo MR images showing a well-defined encapsulated nodule, localized in the transitional zone, right side, at the level of the base, which appears of heterogeneous signal intensity, predominantly high signal (*arrow*).

GLANDULAR BPH NODULE



NON-CANCEROUS ABNORMALITIES



BENIGN PROSTATIC HYPERPLASIA

(A). Axial T2W fast spin-echo MR image shows at least two nodules, one of them is a well-defined oval nodule, encapsulated, with low signal intensity (*arrow*) in the anterior aspect of left central zone, mid-gland.

(B). Axial ADC map shows decrease signal intensity (*arrow*) of nodule.

(C). Axial echo-planar image ($b=1500 \text{ mm}^2/\text{s}$) corresponding to B shows nodule as a moderate high-signal-intensity lesion (*arrow*).

(D) Axial DCE - T1W gradient-echo MR image shows early and homogeneous arterial enhancement (*arrow*).

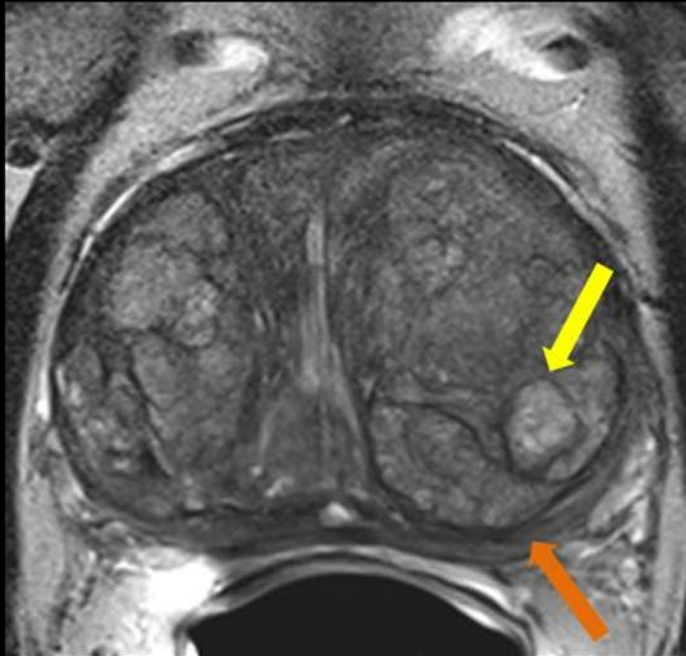
STROMA-RICH BPH NODULE

Sclerotic, fibrotic and muscular components

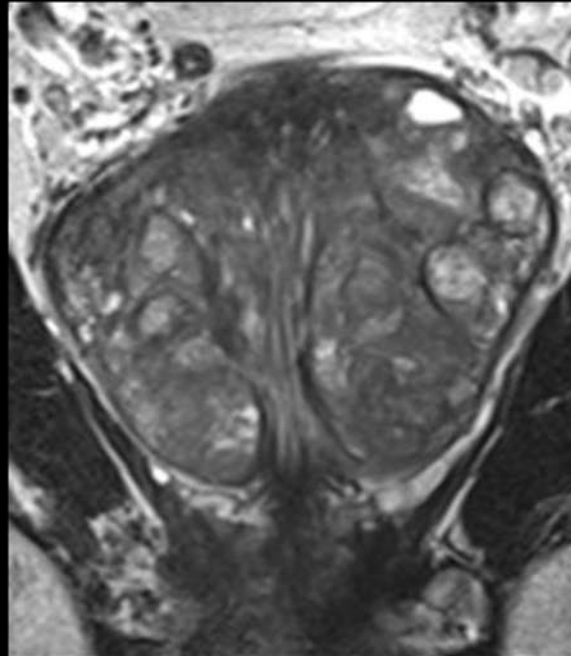


CENTRAL GLAND HYPERTROPHY

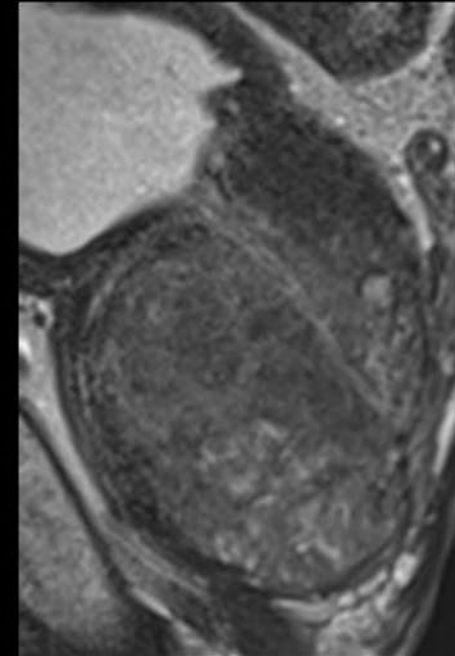
T2 Axial



T2 Coronal



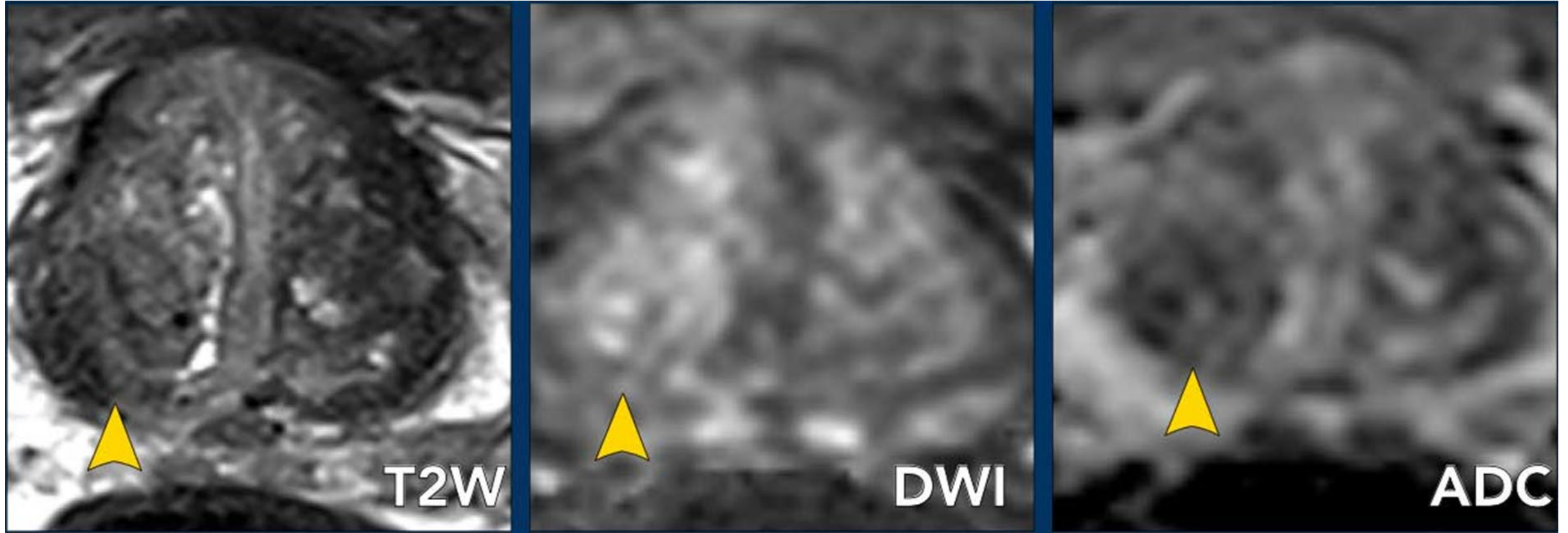
T2 Sagittal



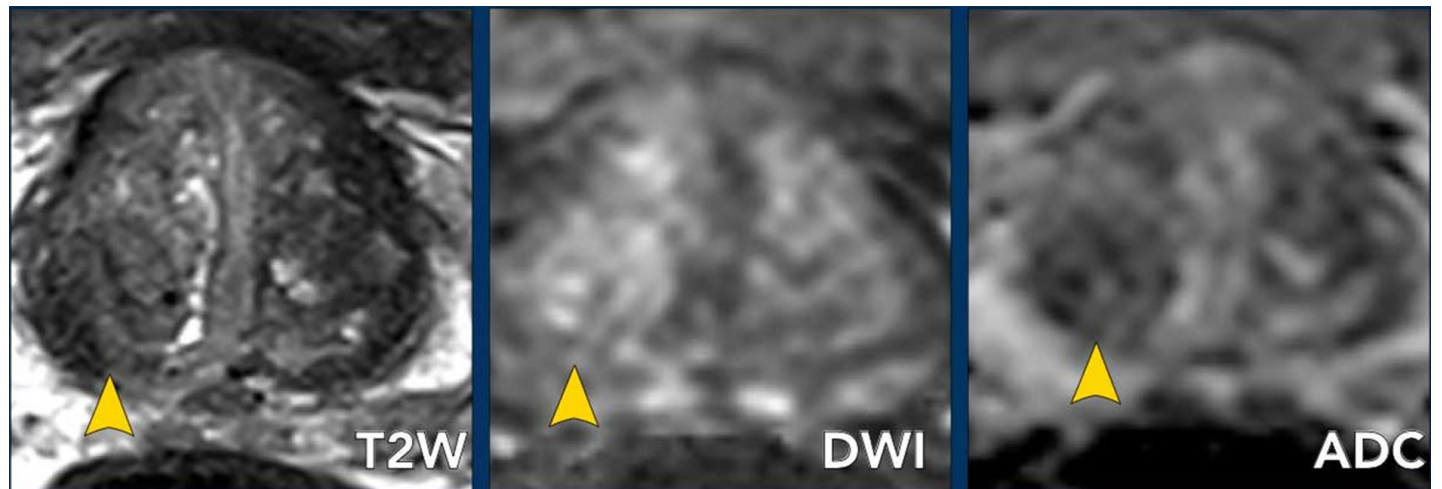
Effaced Peripheral Zone (PZ)

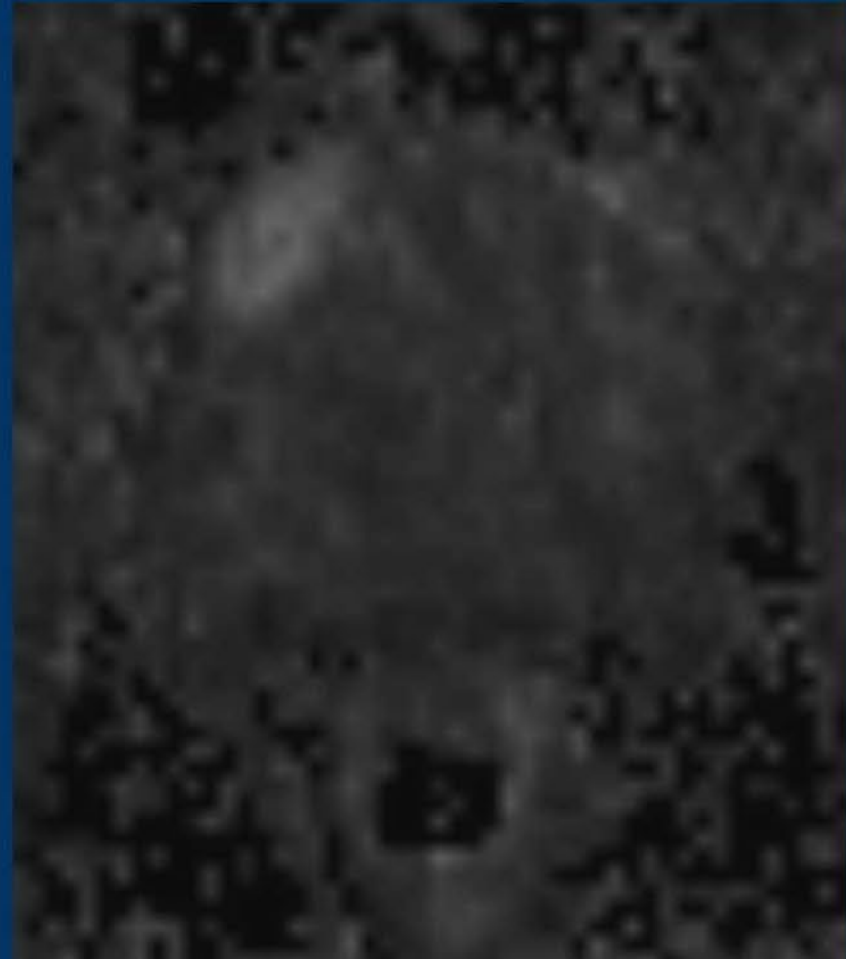
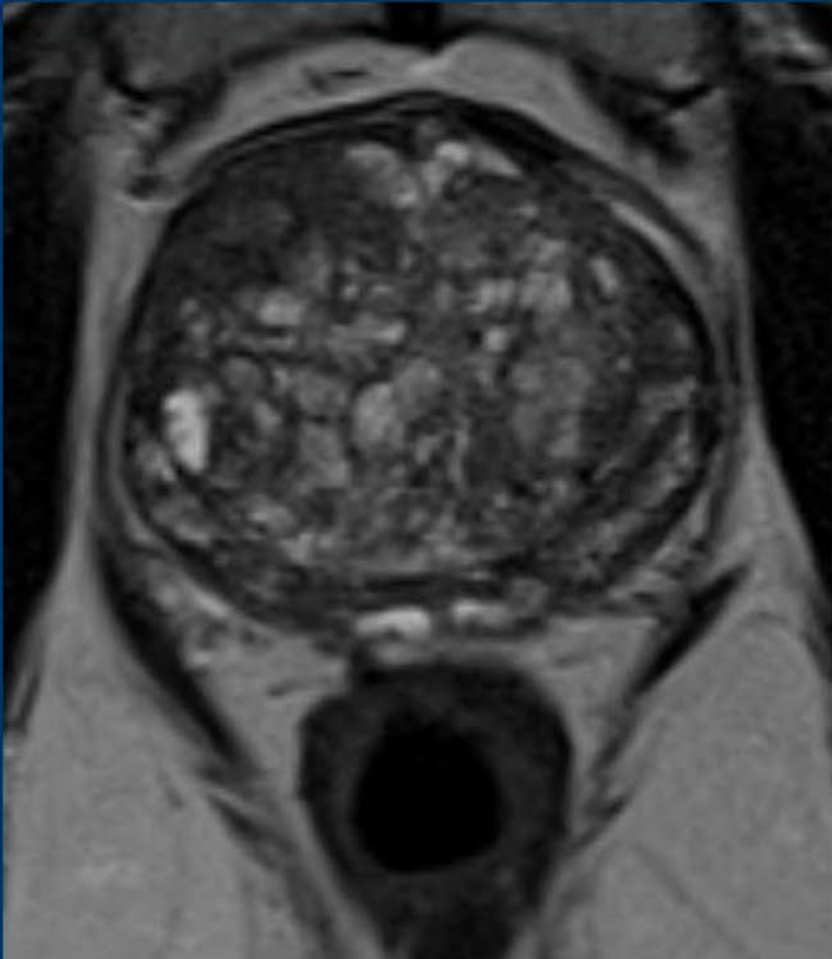
Confusing Central Gland Nodules





- T2 non-circumscribed score 3 Rt TZp
- DWI/ADC score 3
- PIRADS 3

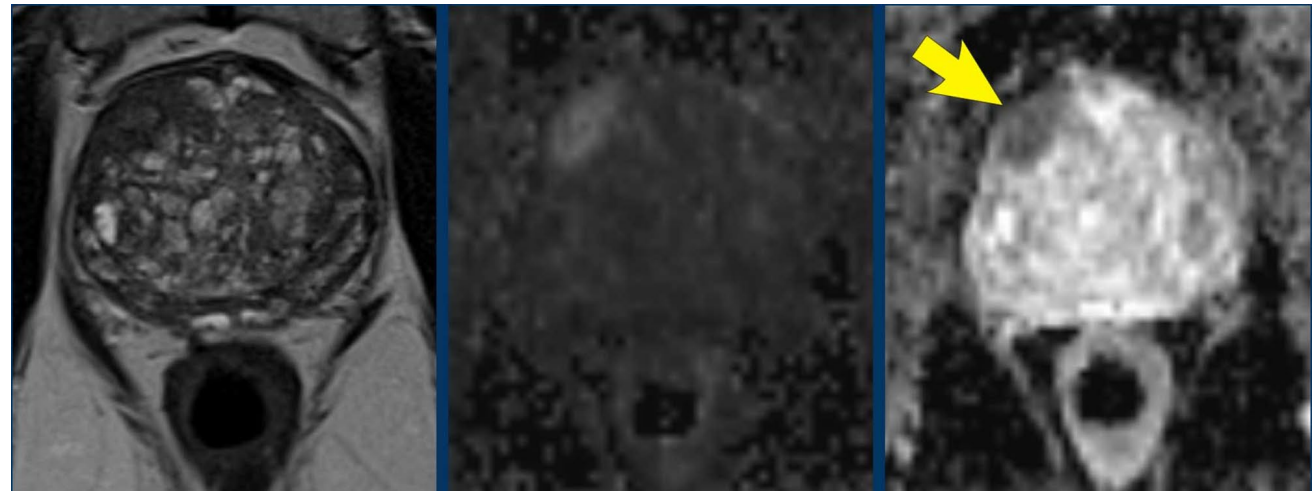


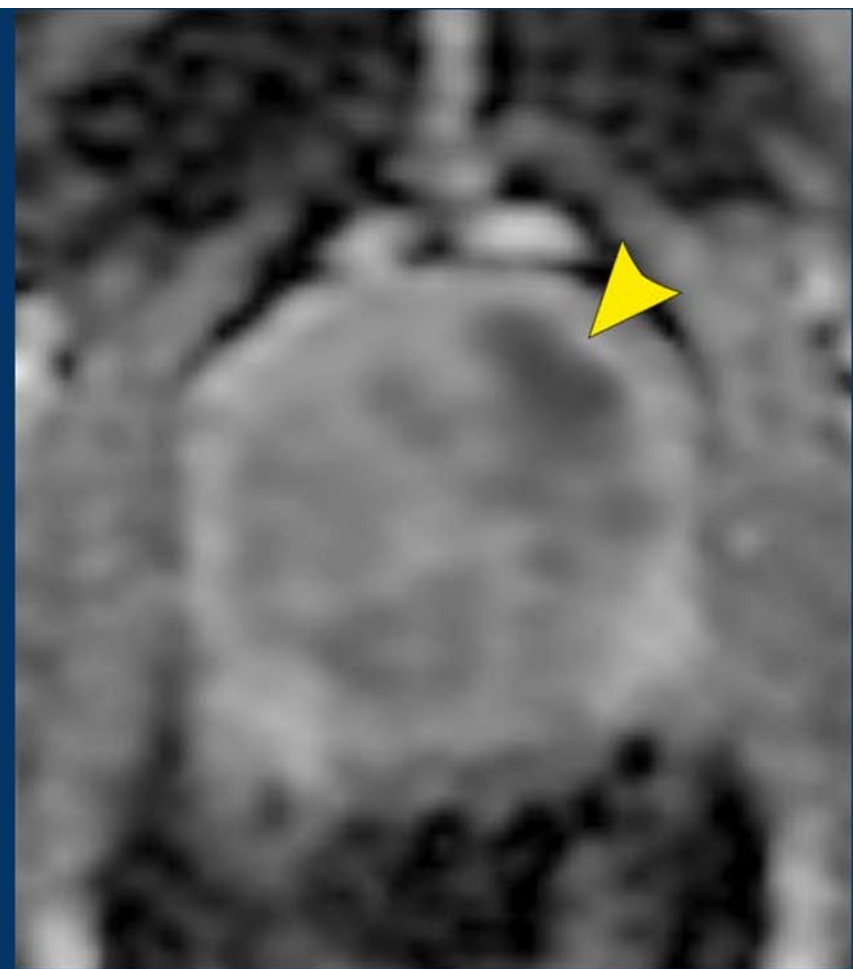
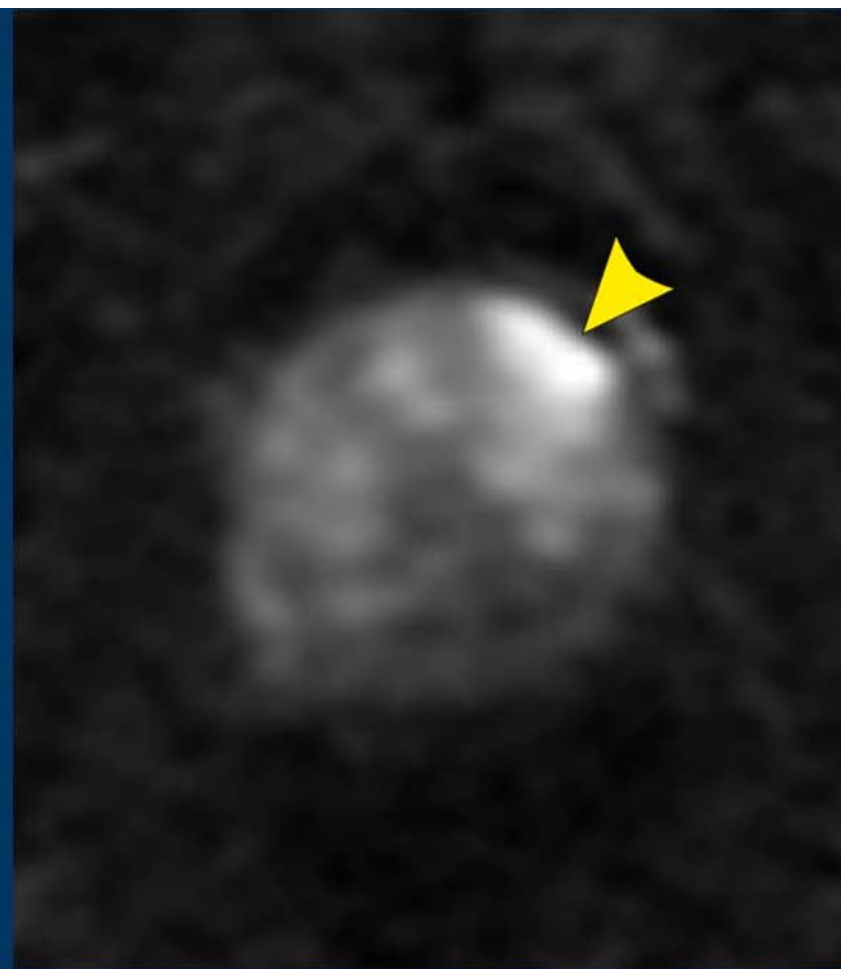
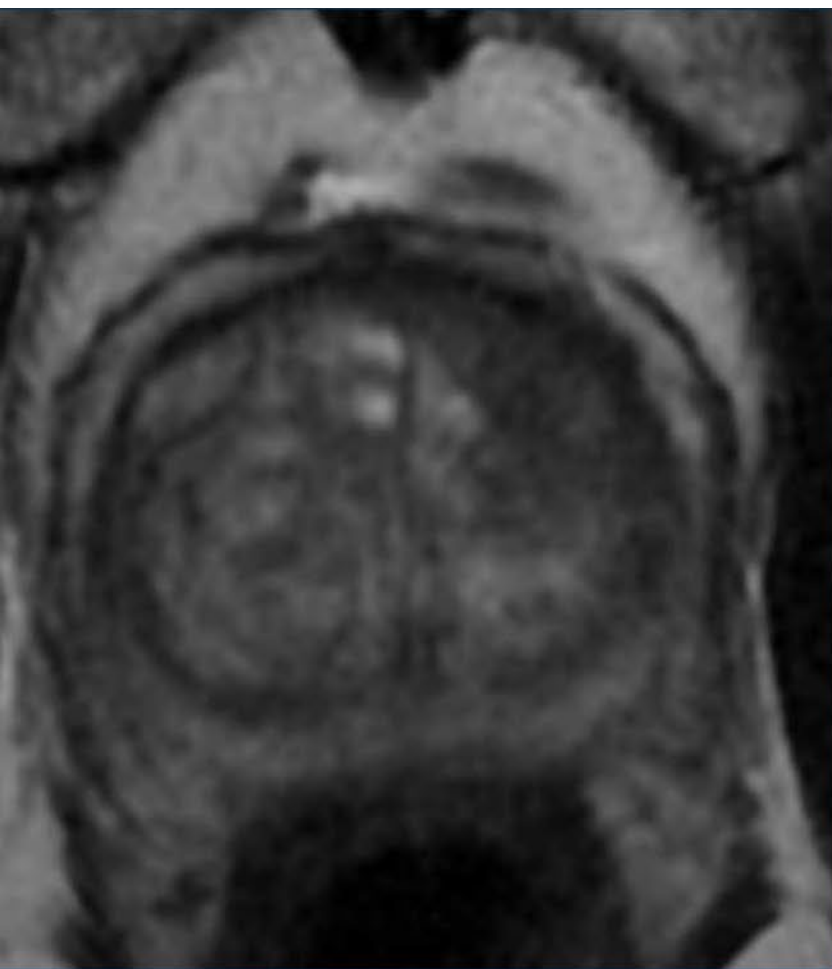


- 79 y o
- PSA 6.4 ng/ml
- PSA density 0.05

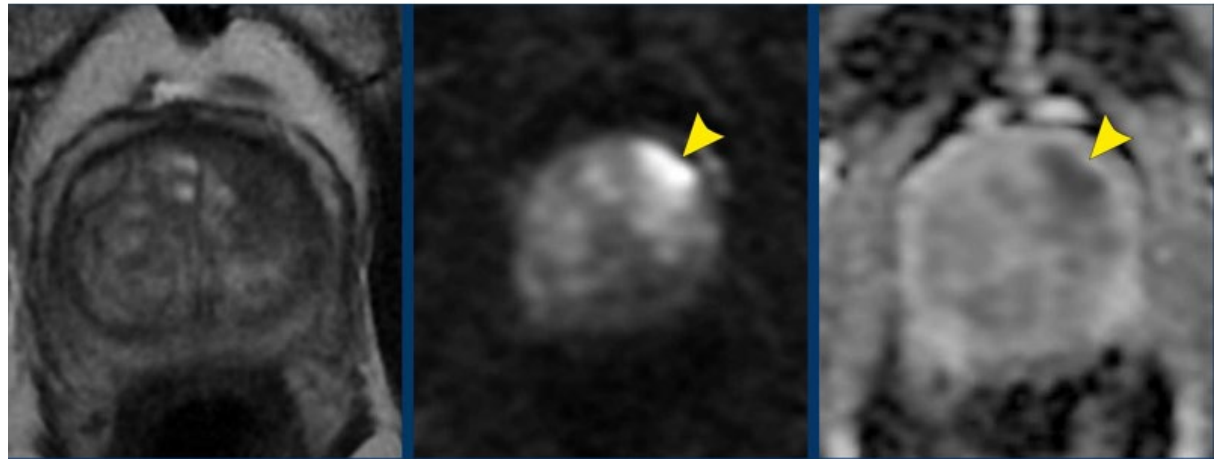


- **T2** score 4 Rt Tza midgland
- Size 1.2 mm
- **ADC/DWI** score 4
- **PIRADS 4**
- G 4+5

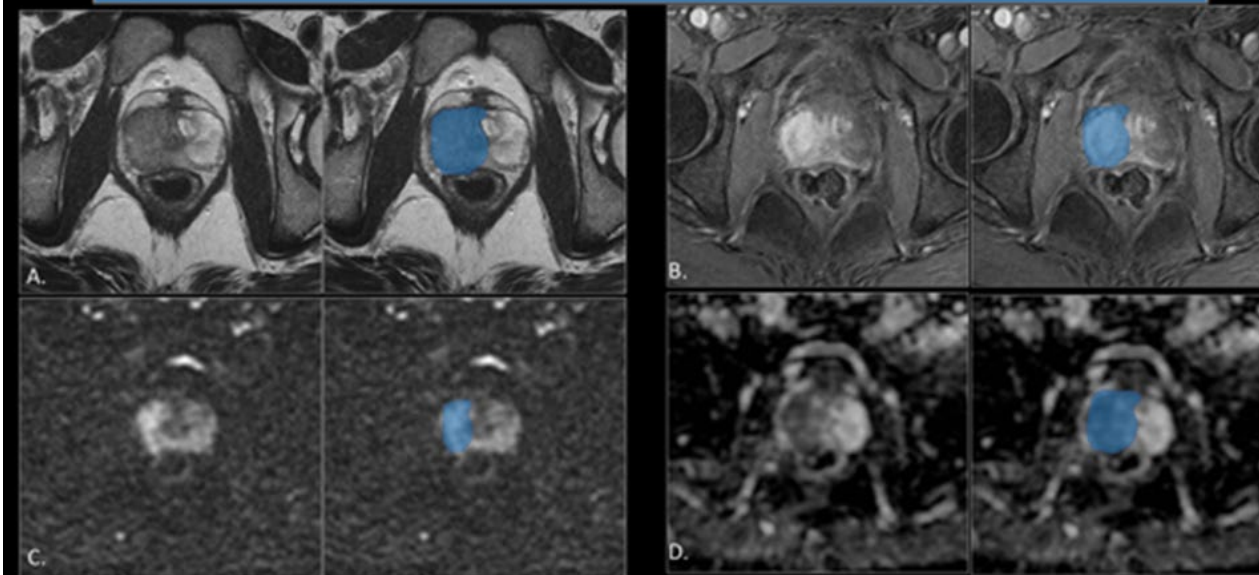




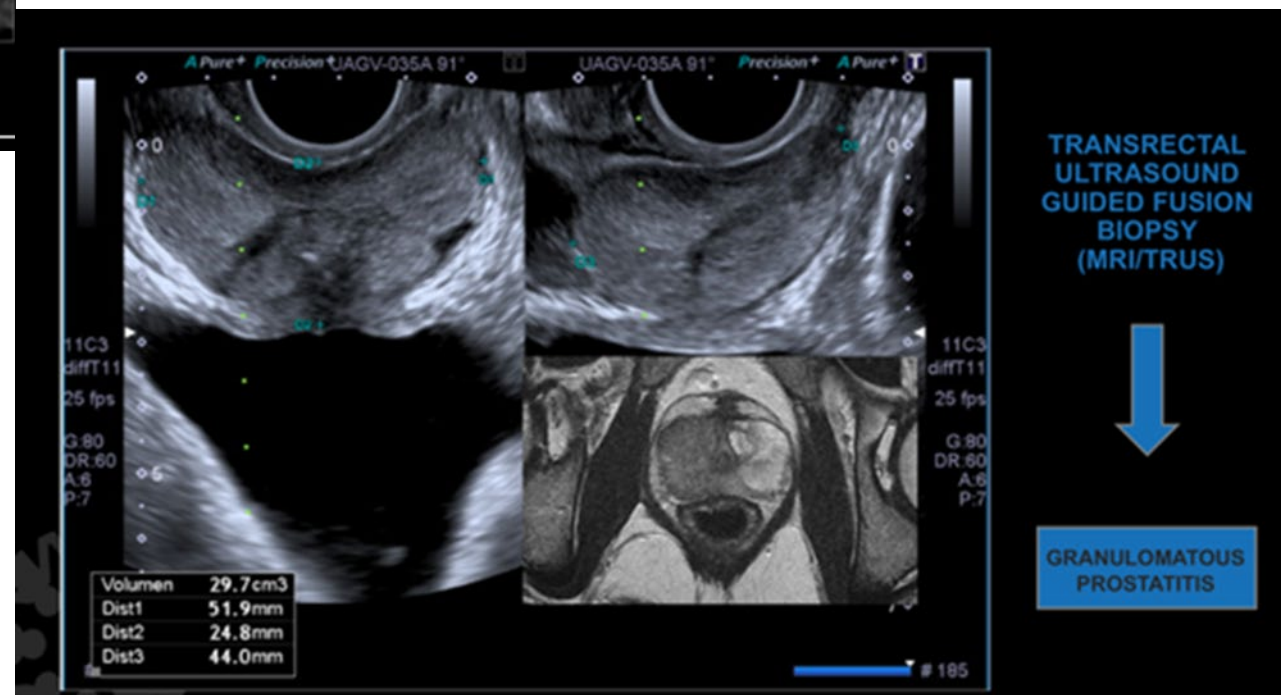
- T2 lenticular score 4 Lt Tza
- ADC/DWI score 4
- PIRADS 4



51yo man with history of recurrent urinary tract infections. DRE: enlarged and firm prostate



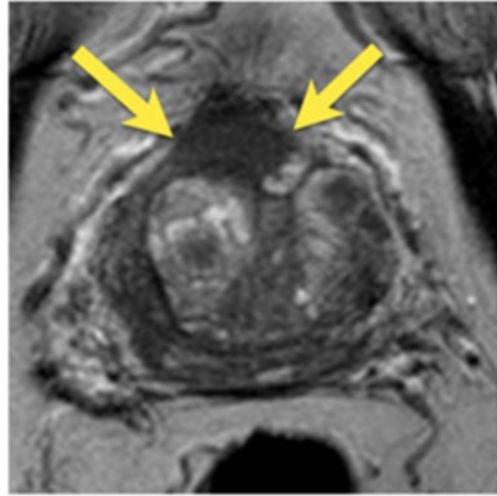
(A) T2WI , (B) Dynamic contrast enhanced T1WI, (C) Diffusion weighted Images (DWI), and (D) Apparent Diffusion Coefficient (ADC) of the prostate, showing a focal area of mildy decreased T2 signal intensity, decreased ADC signal, and abnormal enhancement in the midgland - right transitional zone.



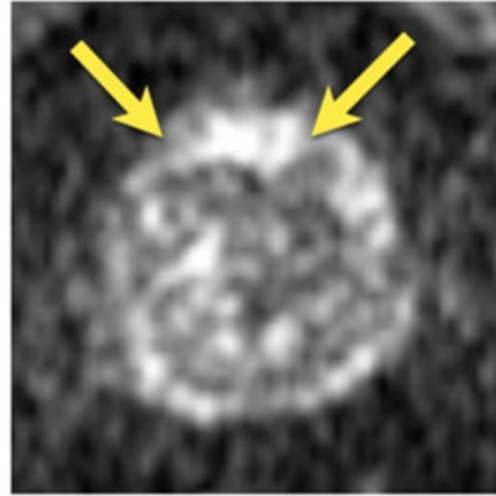
TRANSRECTAL
ULTRASOUND
GUIDED FUSION
BIOPSY
(MRI/TRUS)

GRANULOMATOUS
PROSTATITIS

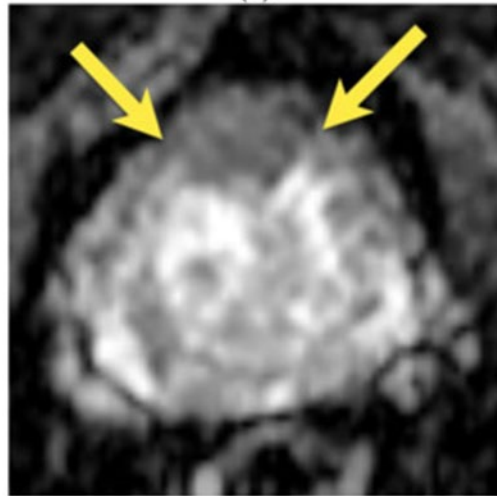




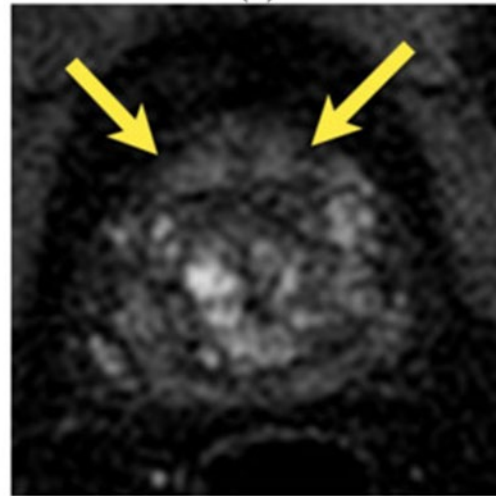
(a)



(b)



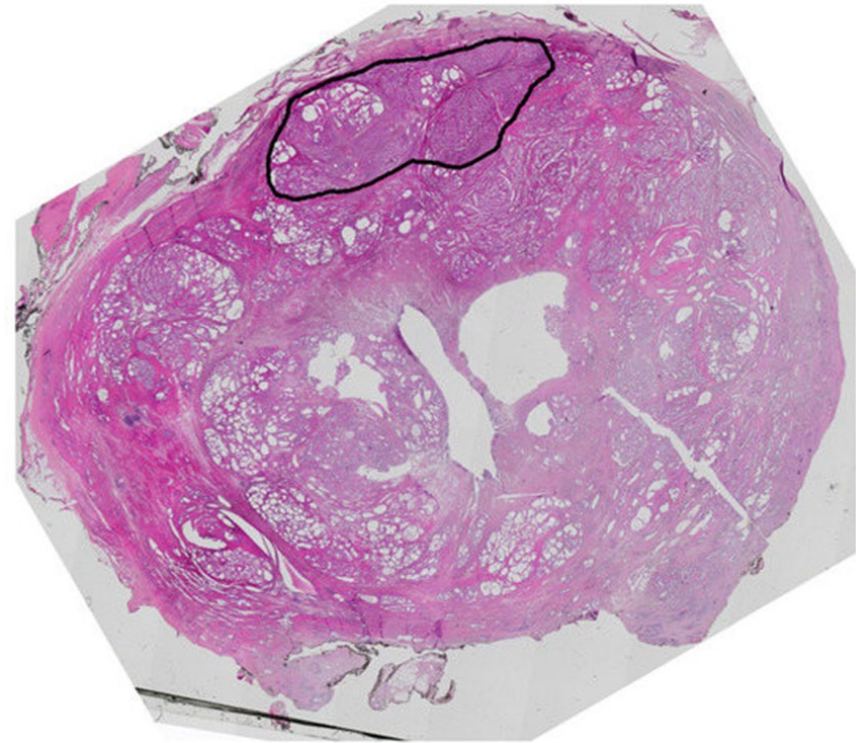
(c)



(d)



- **T2** lenticular and erased charcoal score 5
- AFMS
- **ADC/DWI** score 5
- **DCE** early enhancement
- **PIRADS 5**
- Radical prostatectomy G 4+3



(e)



PZ

- Is there a focal abnormality?

No: 1

Linear/wedge: 2

Focal : continue

- Are both ADC and high-b DWI markedly abnormal?

Only one: 3

Both: continue

- Size?

<1.5 cm: 4

>1.5 cm : 5

TZ

No : continue

Lenticular : 4 or 5

Encapsulated : 1 or 2



- **Early Focal Enhancement(30 – 60 s) Corresponding with T2/DWI**
- contemporaneous
- **PZ + DWI 3 + DCE positive = PIRADS 4**
- **TZ + T2 score 3 + DCE positive ≠ PIRADS 4**
- **TZ + T2 score 3 + DWI 5 = PIRADS 4**
- **BPH nodules can have early enhancement.**

