

Pitfalls in Prostate MRI

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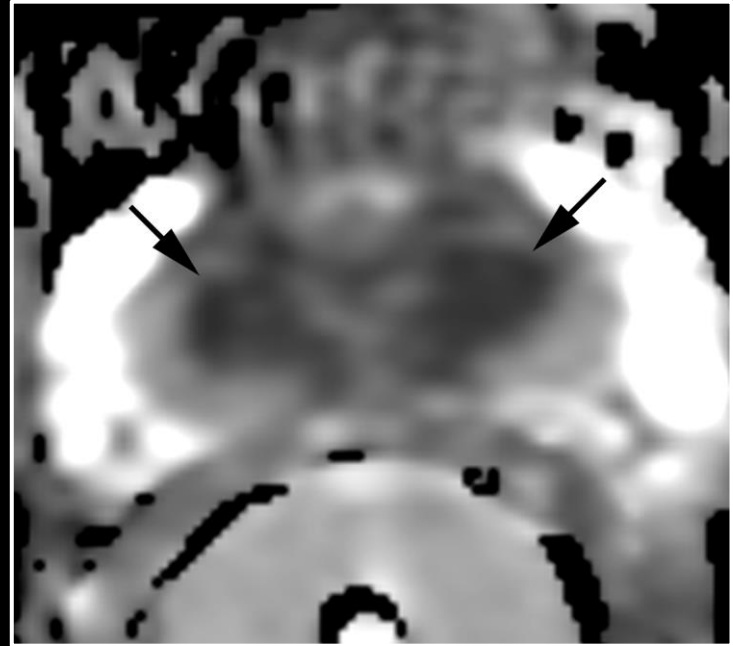
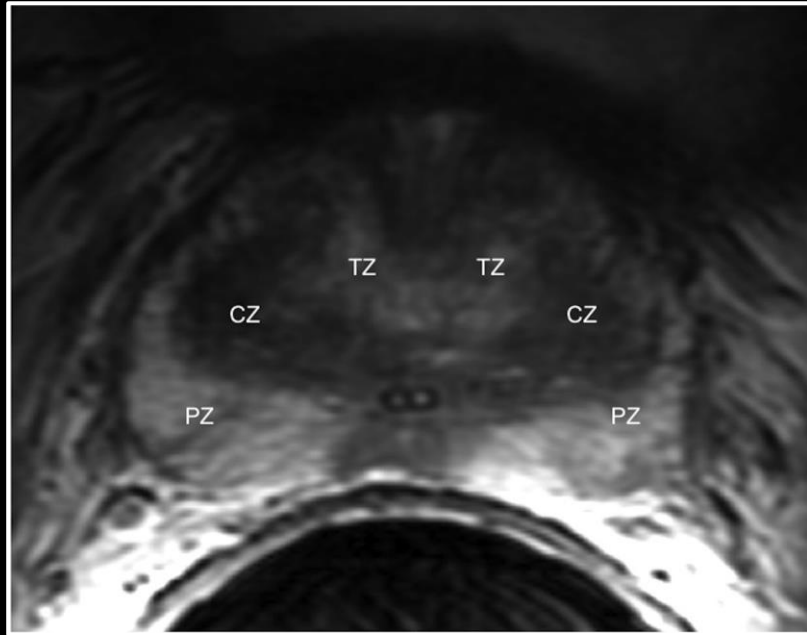
Outline

- Normal structures that may mimic tumor
- Benign pathologies that may mimic tumor
- Potential sites of overlooked tumors

Central Zone

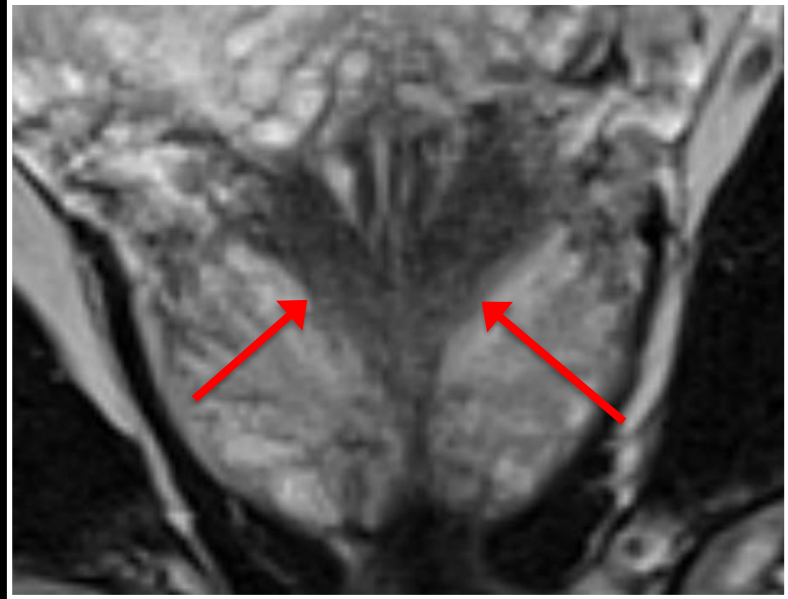
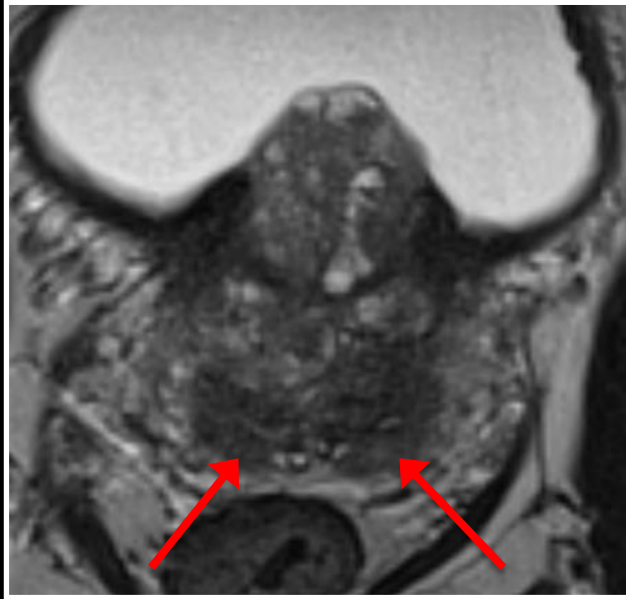
- Distinct from transition zone
- Symmetric structure at posterior base
- Wedge-shaped on coronal images
- Encircles ejaculatory ducts
- Potential source of miscall for high-suspicion lesion as well as for associated EPE/SVI

Central Zone



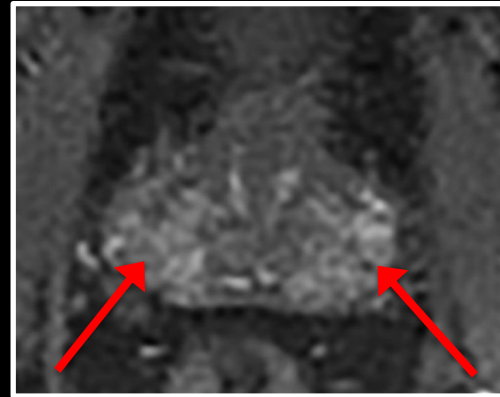
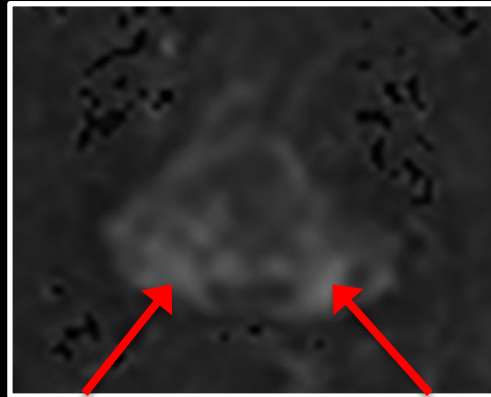
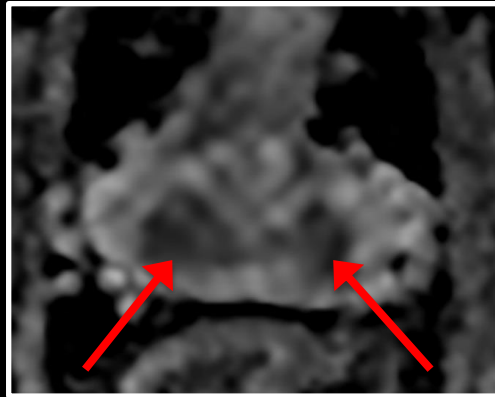
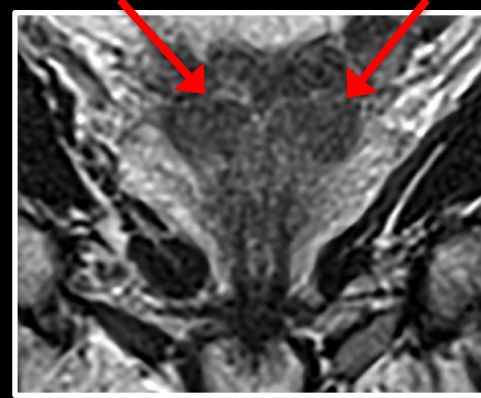
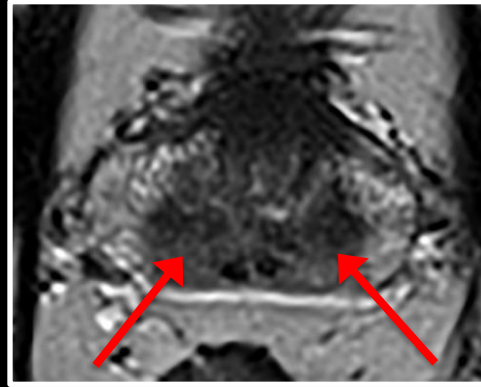
Gupta RG et al. *AJR*: 2015;205:331-6.

Central Zone

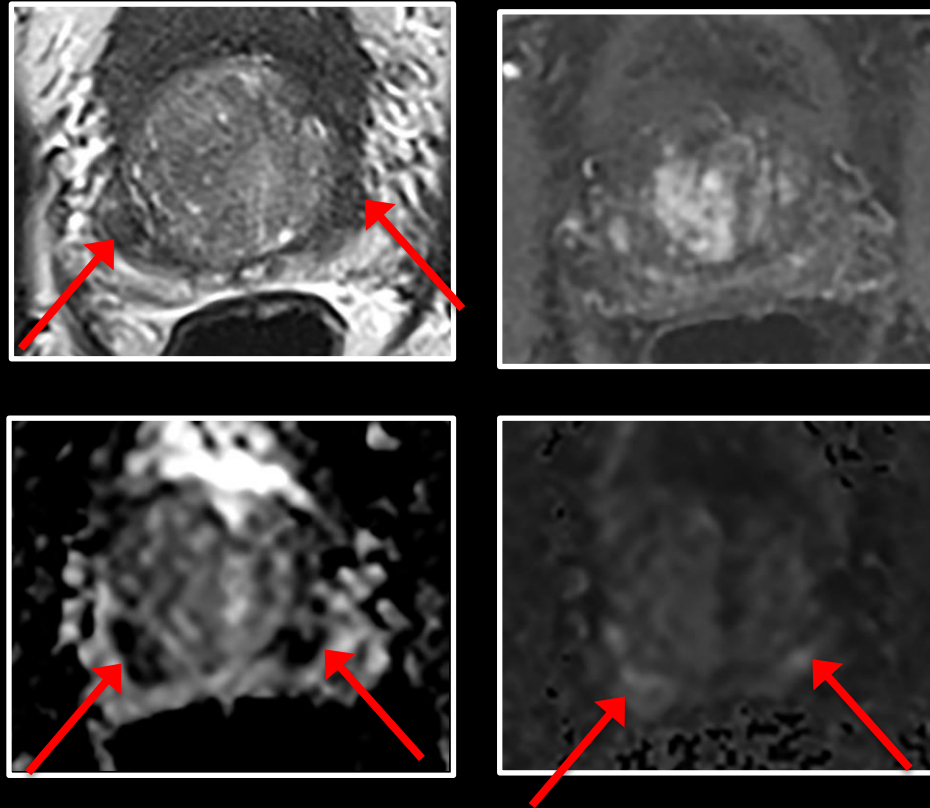


Rosenkrantz AB et al. AJR;2014;202:109-20.

Central Zone



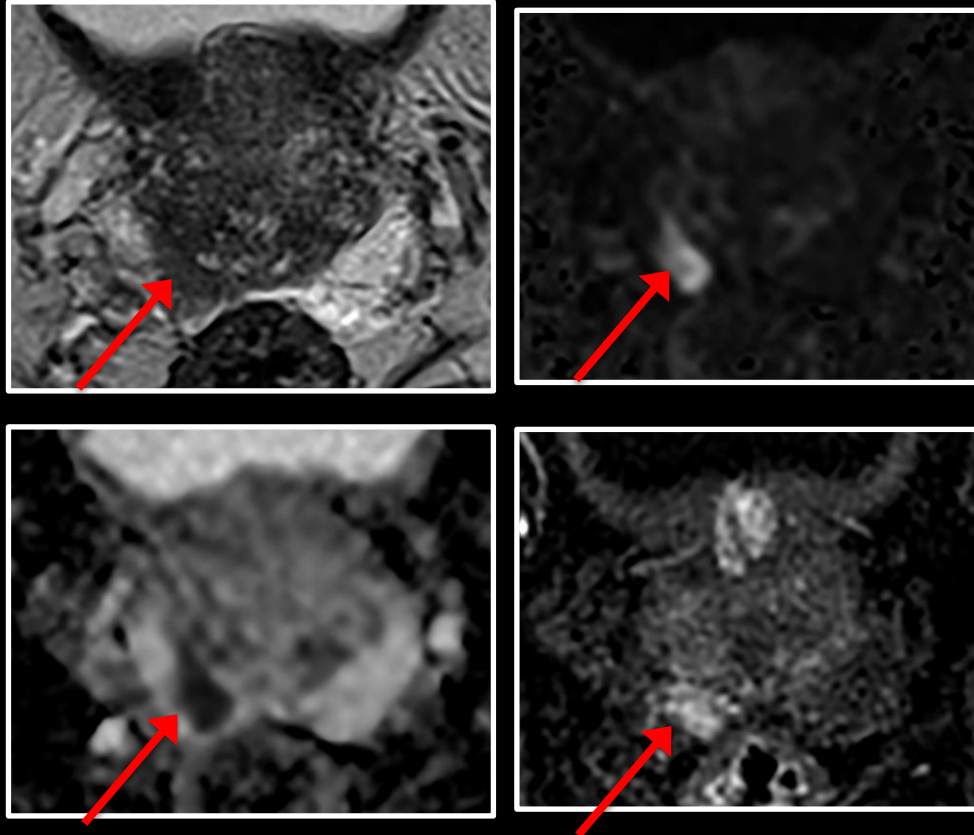
Central Zone



Central zone tumor

- <5% of prostate cancers
- Reported to be relatively aggressive:
 - Higher grade & frequency of EPE/SVI
- Suggestive findings:
 - Asymmetry
 - More pronounced reduction in ADC
 - Type I enhancement pattern

Central zone tumor

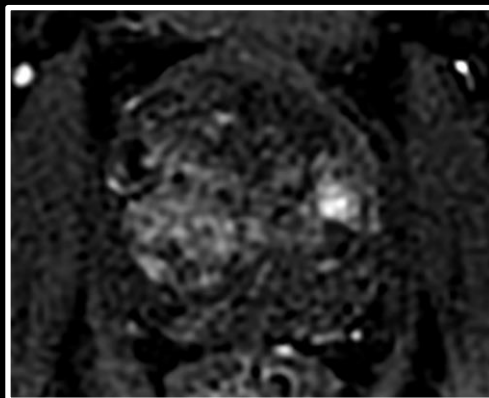
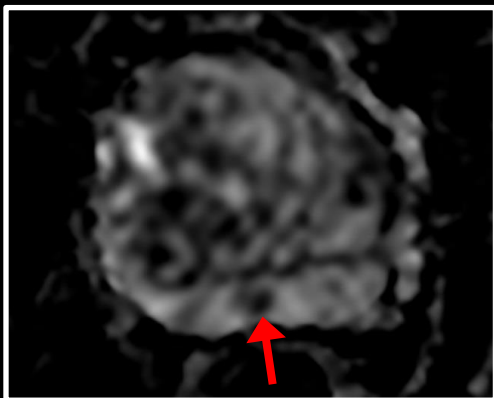
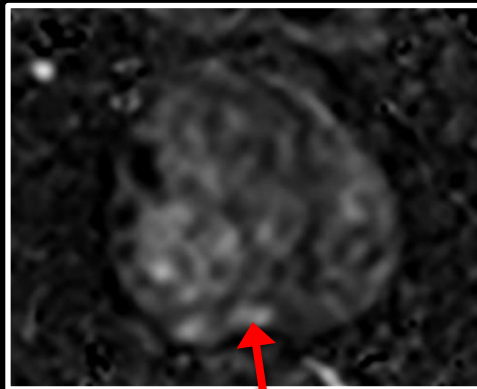
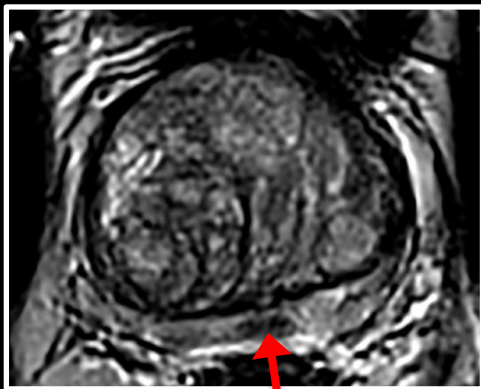


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Posterior midline pseudolesion

- Wedge-shaped region of decreased T2 signal and ADC at posterior midline
- May relate to fusion and thickening of the prostatic capsule and overlying fascia by the junction of the two lobes

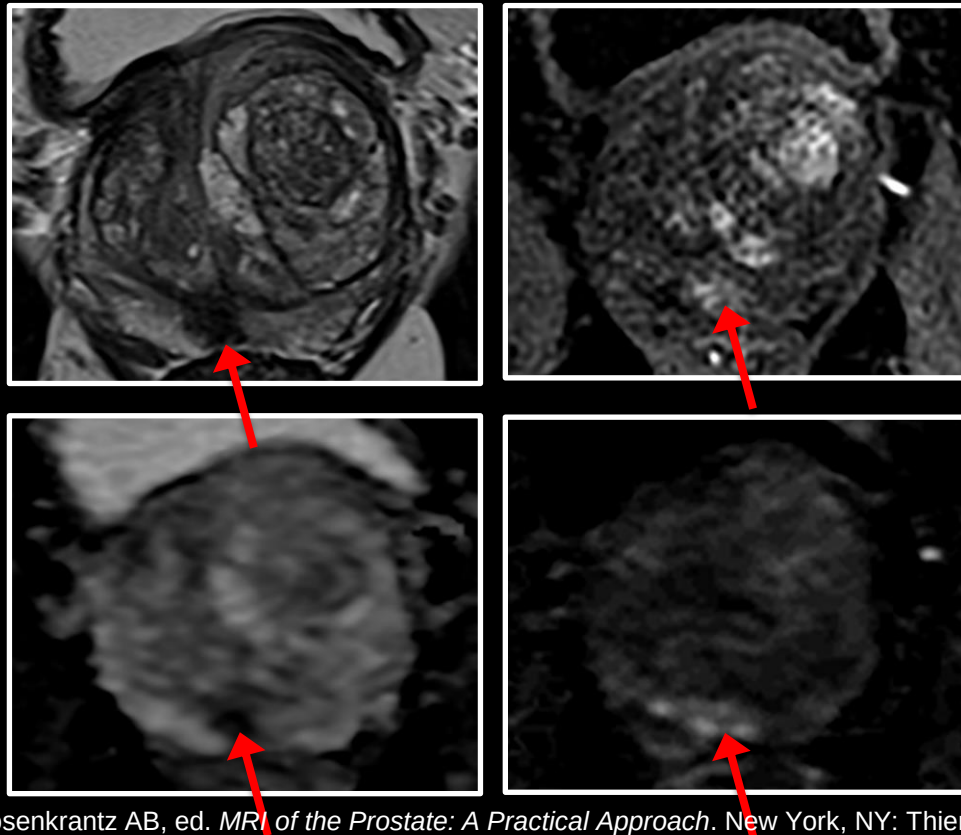
Posterior midline pseudolesion



Posterior midline tumor

- More rounded and mass-like shape in comparison with the pseudolesion
- Caudal extension below the prostate base
- Asymmetry (off midline)
- Type I enhancement kinetics

Posterior midline tumor

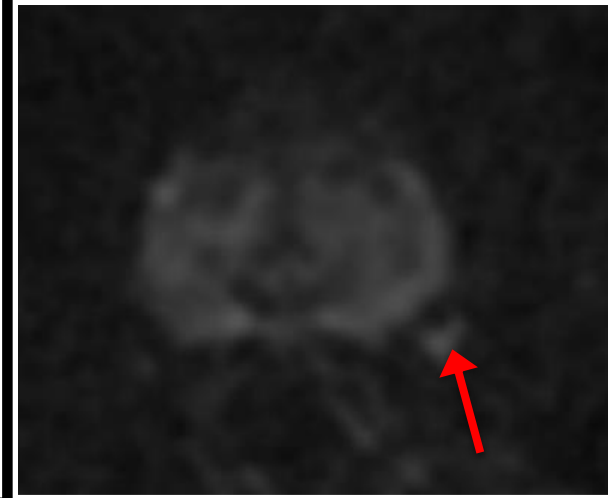
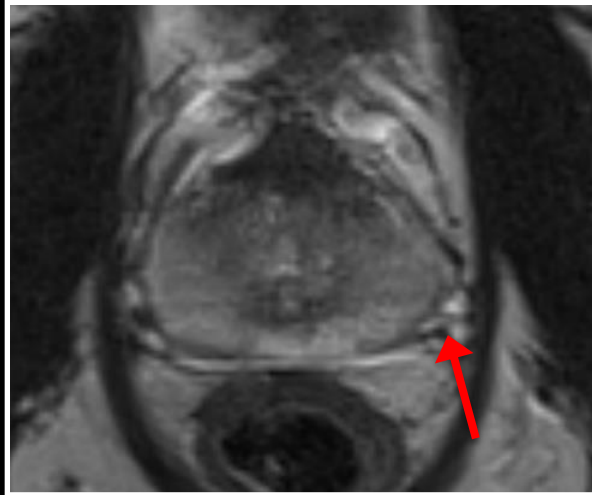
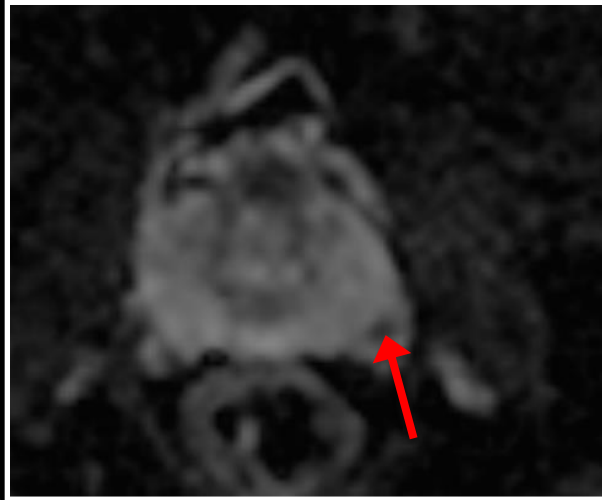


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Periprostatic neurovascular tissue

- Periprostatic venous plexus and NVB intimately draped along the prostate capsule
- May pose particular pitfall on ADC map given underlying distortion and low signal
- Careful comparison with T2WI and DCE
- Delayed phases and other planes of value

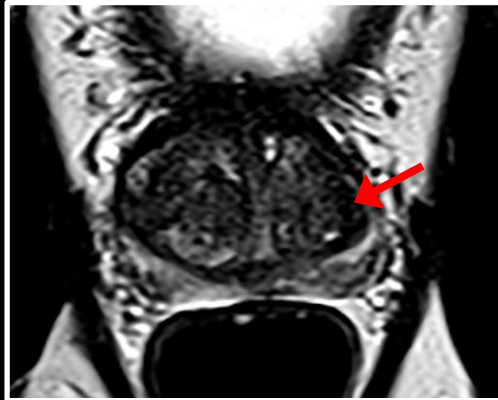
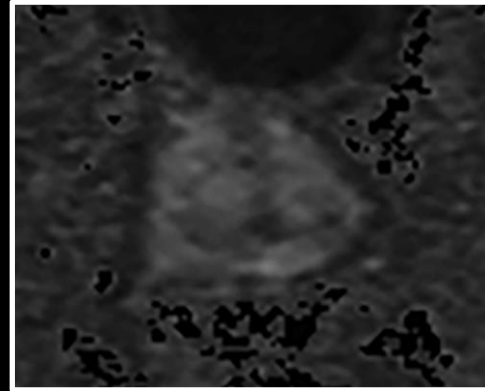
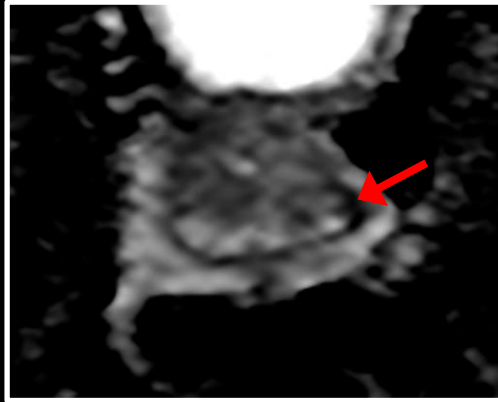
Neurovascular bundle



PZ/TZ junction

- Fibrous pseudocapsule between PZ and TZ
- May undergo mild asymmetric benign thickening
- Can mimic tumor on ADC map given distortion
- T2WI, DCE helpful

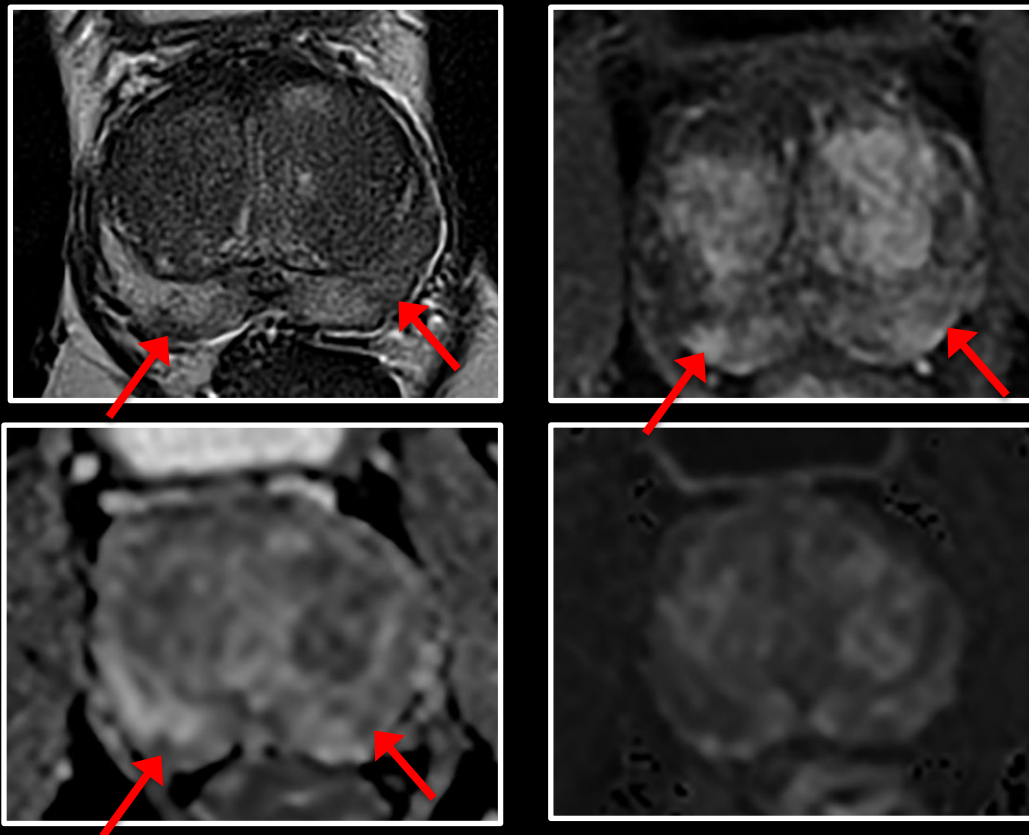
PZ/TZ junction



Prostatitis

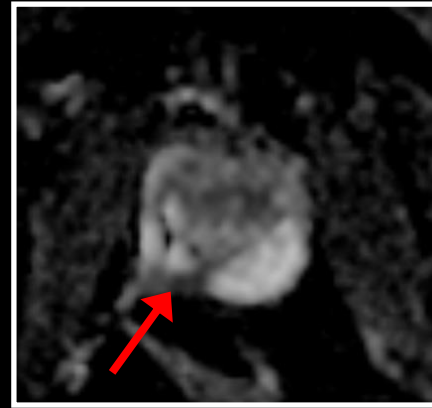
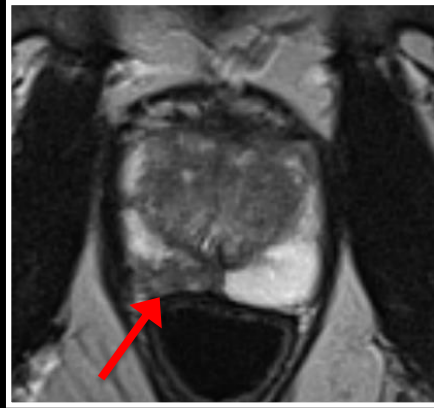
- Broad spectrum of inflammatory and post-inflammatory processes
- May be subclinical with no corresponding history of symptoms of prostatitis
- Potential abnormalities on all sequences
- *Morphology*: wedge/linear shape; lobar distribution
- Relatively *mild* abnormalities
- Sometimes will not be able to differentiate from tumor

Prostatitis



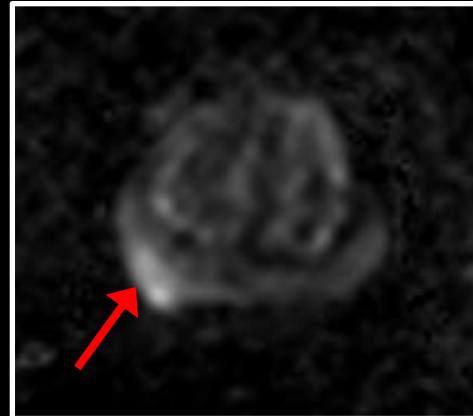
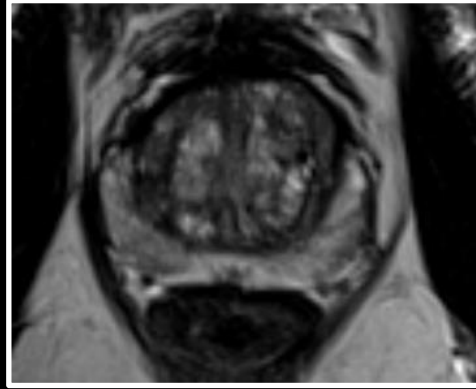
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Prostatitis

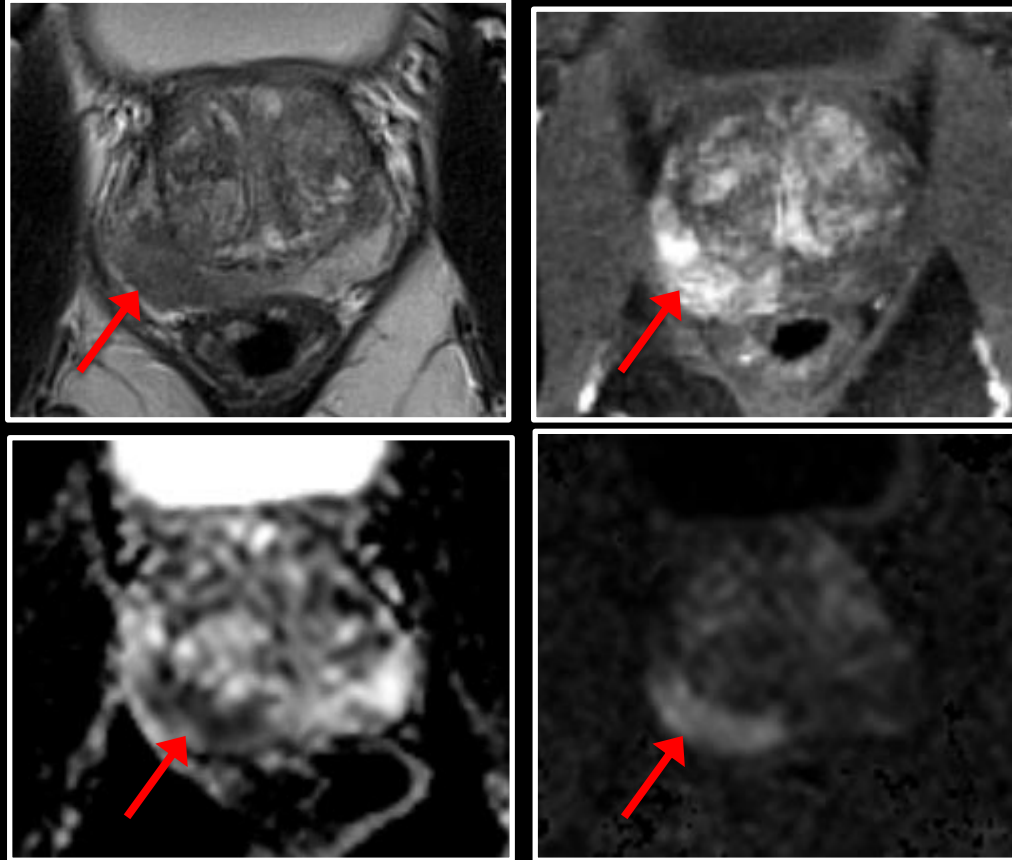


1-year follow-up

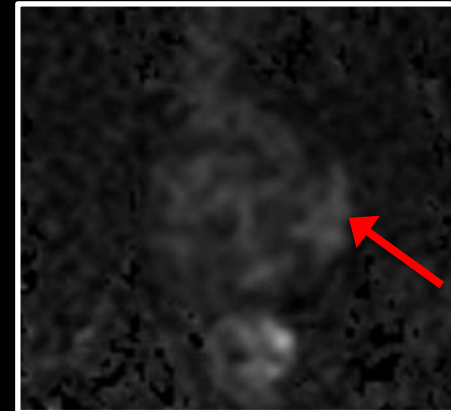
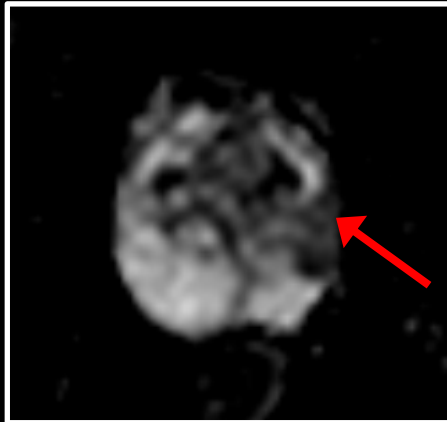
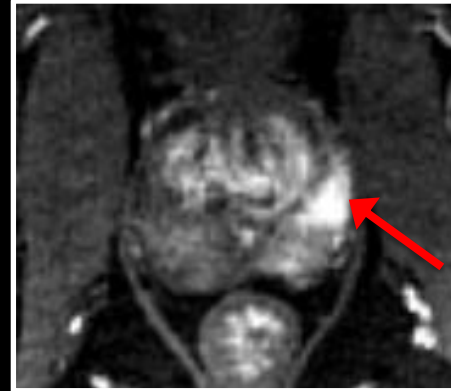
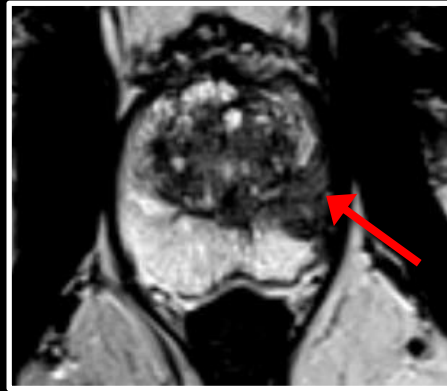
Prostatitis



Prostatitis



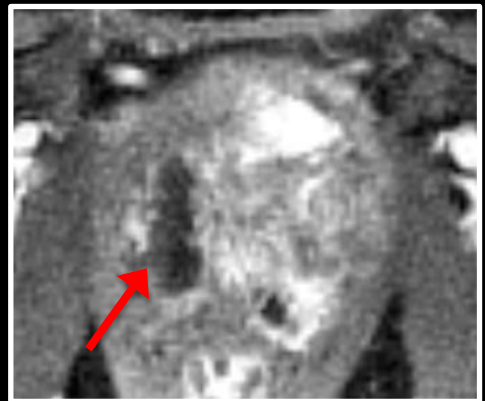
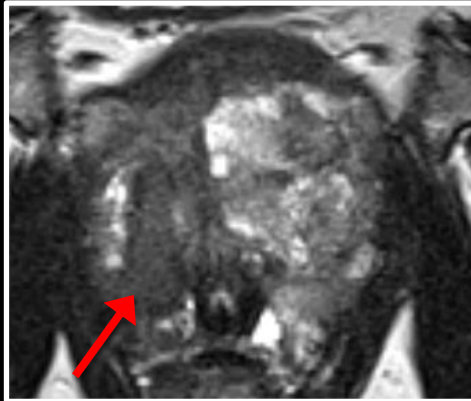
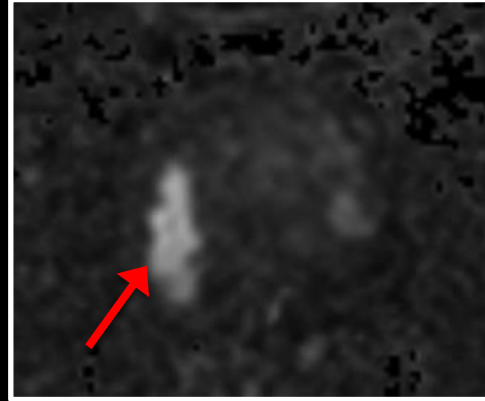
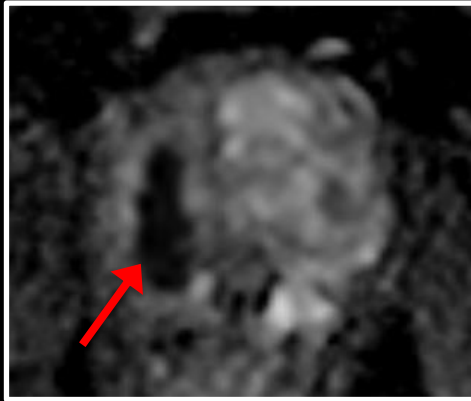
Prostatitis



Granulomatous prostatitis

- Possible history of intra-vesical BCG therapy or tuberculosis exposure
- Often idiopathic
- Marked diffusion restriction
- Possible areas of necrosis (non-enhancement)
- Potential cause of false-positive PI-RADS 5 lesions

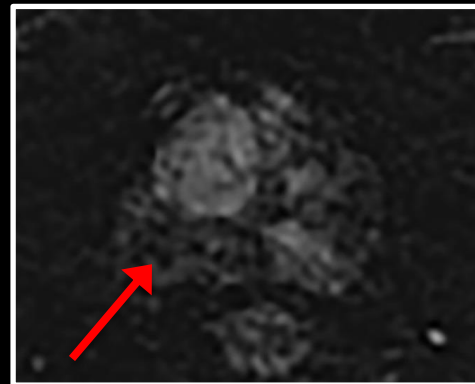
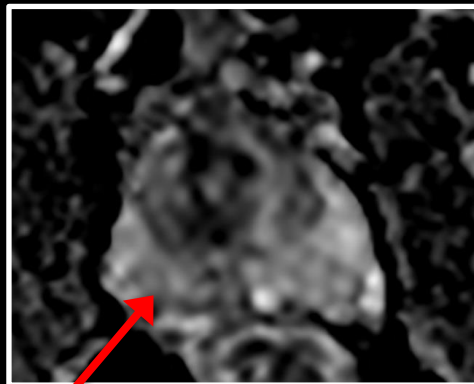
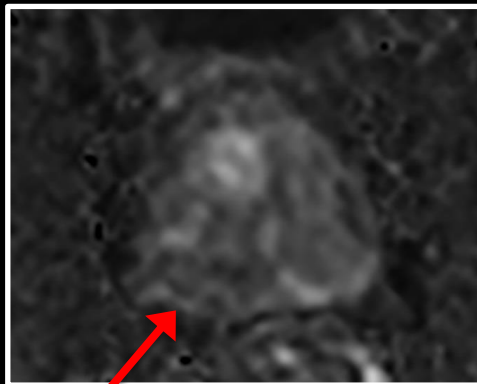
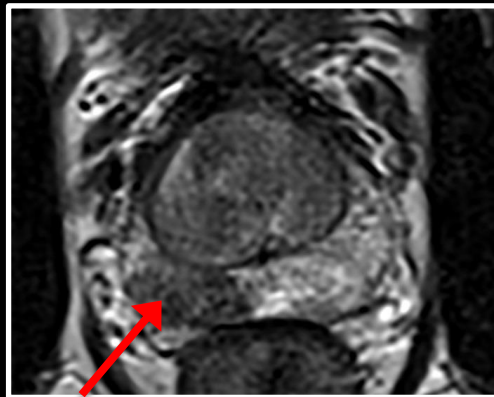
Granulomatous prostatitis



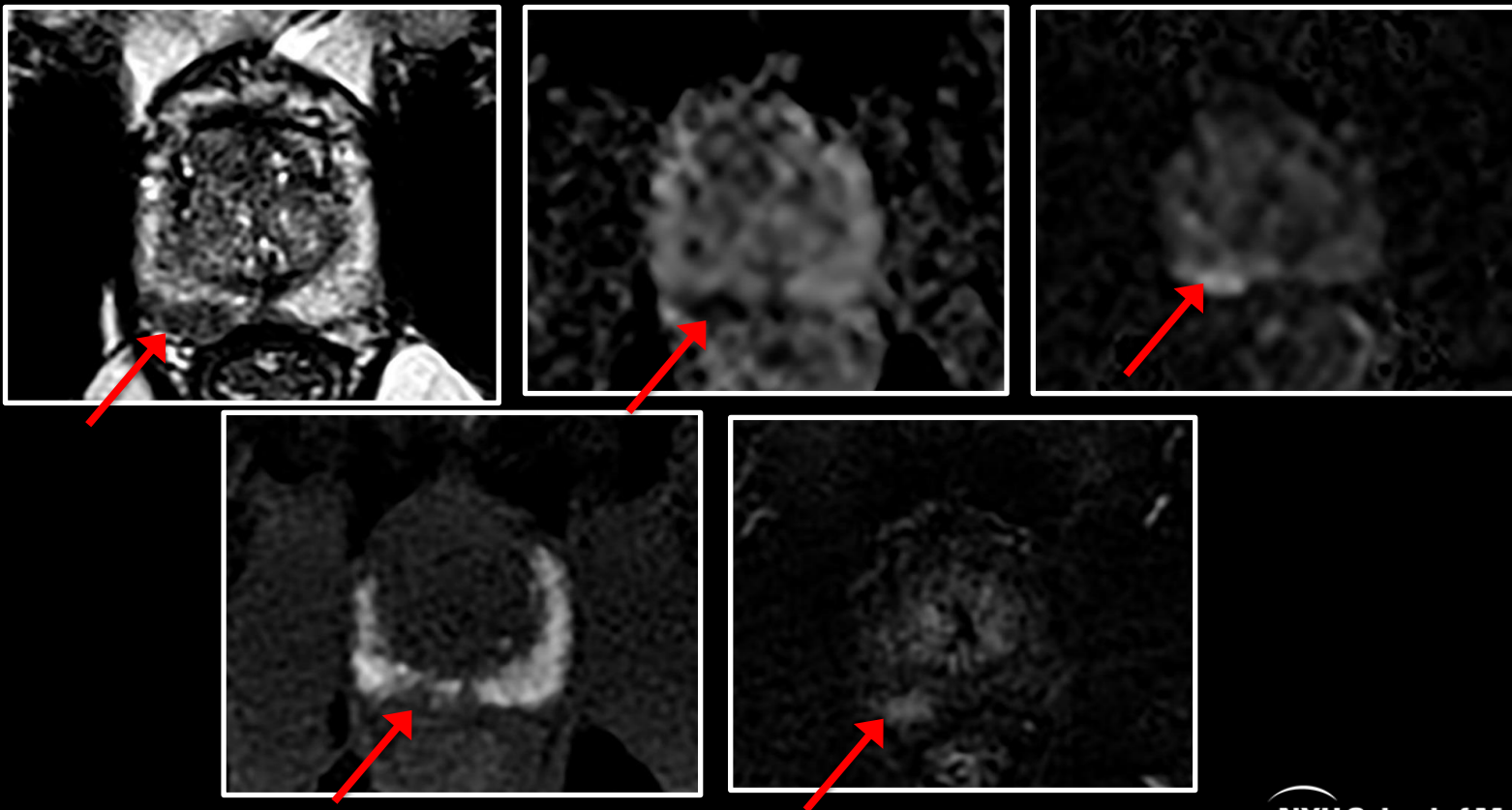
Post-biopsy hemorrhage

- Prostate normally synthesizes citrate
 - anticoagulant effect
- Hemorrhage can persist despite lengthy delays
- Decreased T2 signal
- ADC reduction (though generally mild)
- Changes generally more geographic in comparison with focality of tumors
- Subtraction images helpful for DCE
- “Sparing” of dominant tumors

Post-biopsy hemorrhage

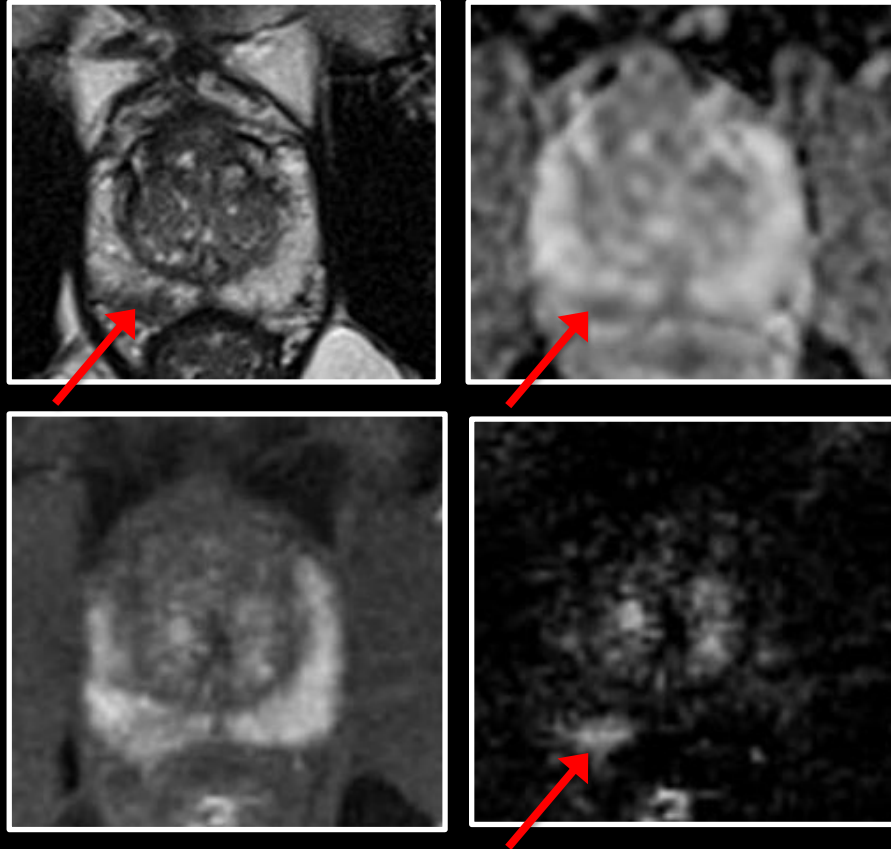


Tumor Visualization on Subtraction images



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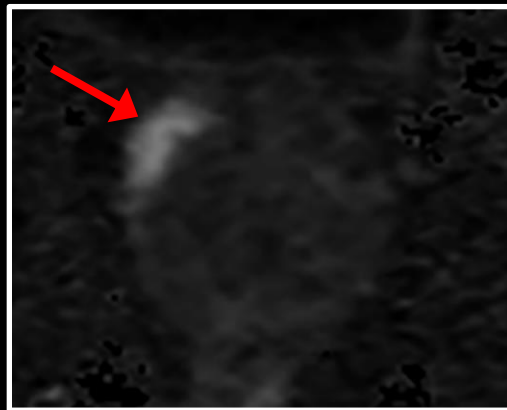
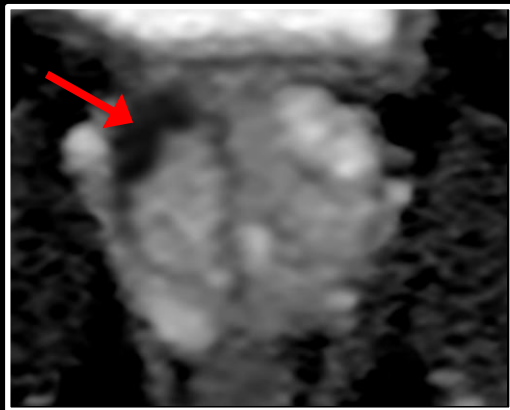
Tumor Visualization on Subtraction images



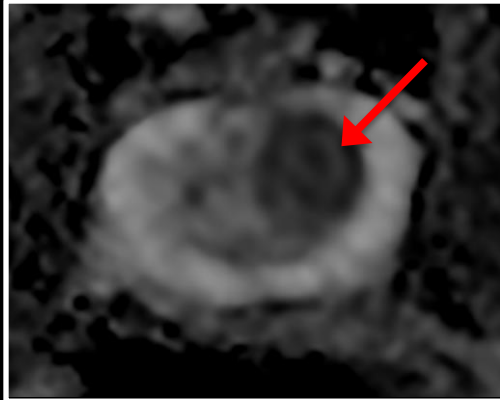
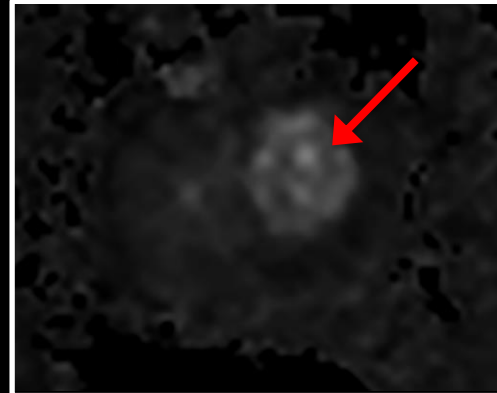
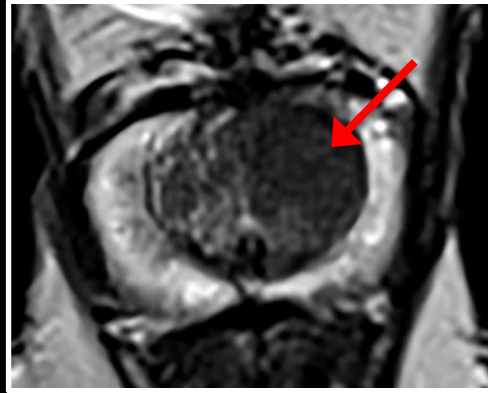
TZ tumor

- Lesion morphology critical (T2WI)
 - Obscured margins
 - Elliptical shape
 - Homogeneity
- Very high b-value images ($\geq 1,400$) may help to separate TZ tumors from stromal BPH
- Use remainder of patient's TZ as internal reference

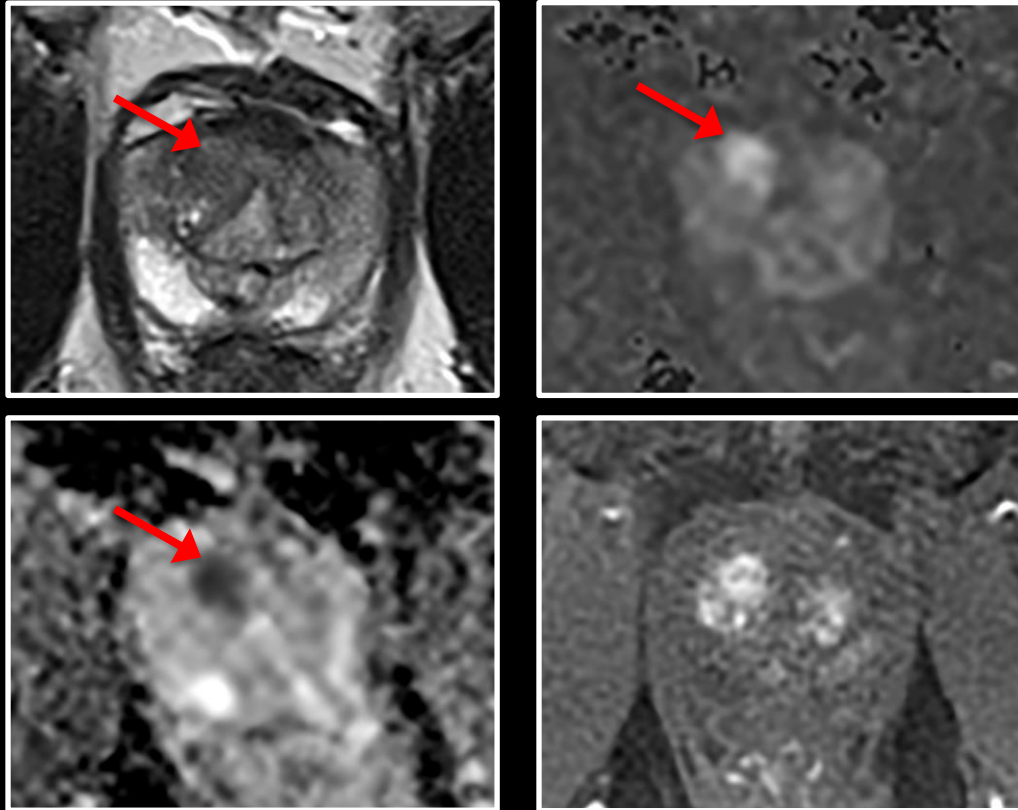
TZ Tumor



TZ Tumor



TZ Tumor

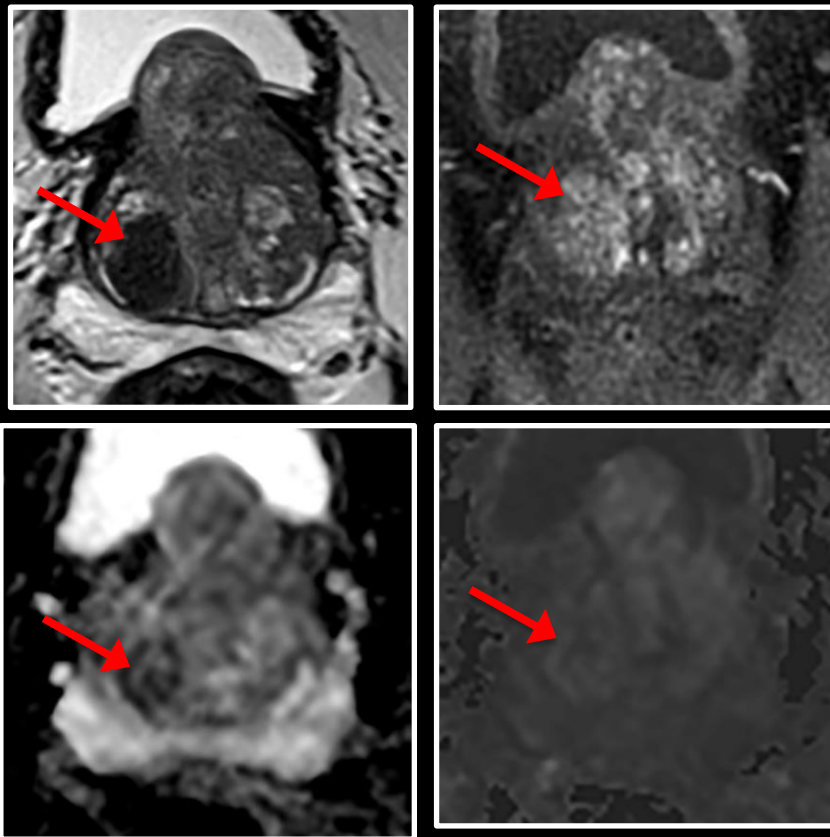


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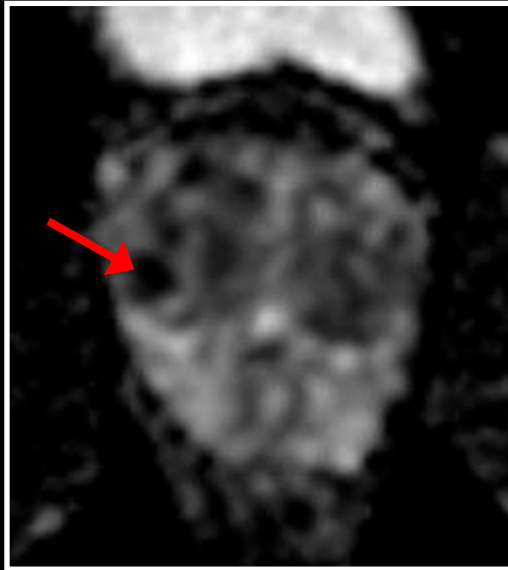
Stromal BPH nodule

- Decreased T2 signal and ADC mimic tumor
- Round/spherical shape
- Circumscribed margin
- Thin T2-hypointense capsule
- Popcorn-like enhancement
- May see areas of similar signal in TZ of same patient

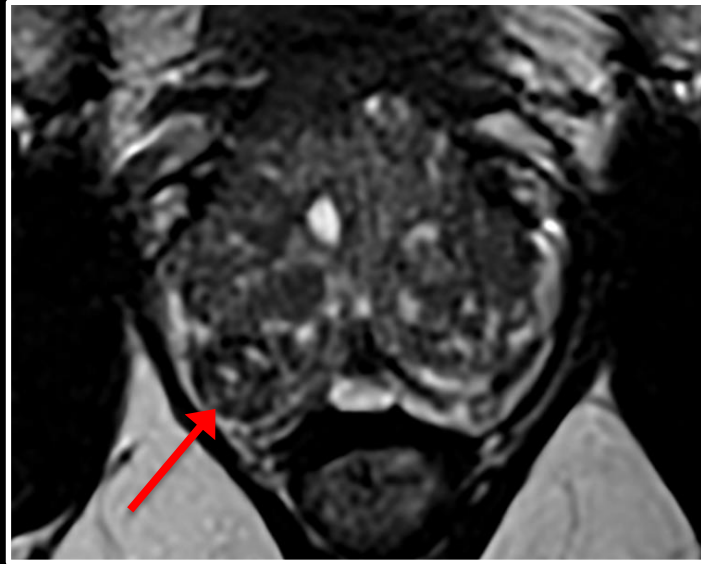
Stromal BPH nodule



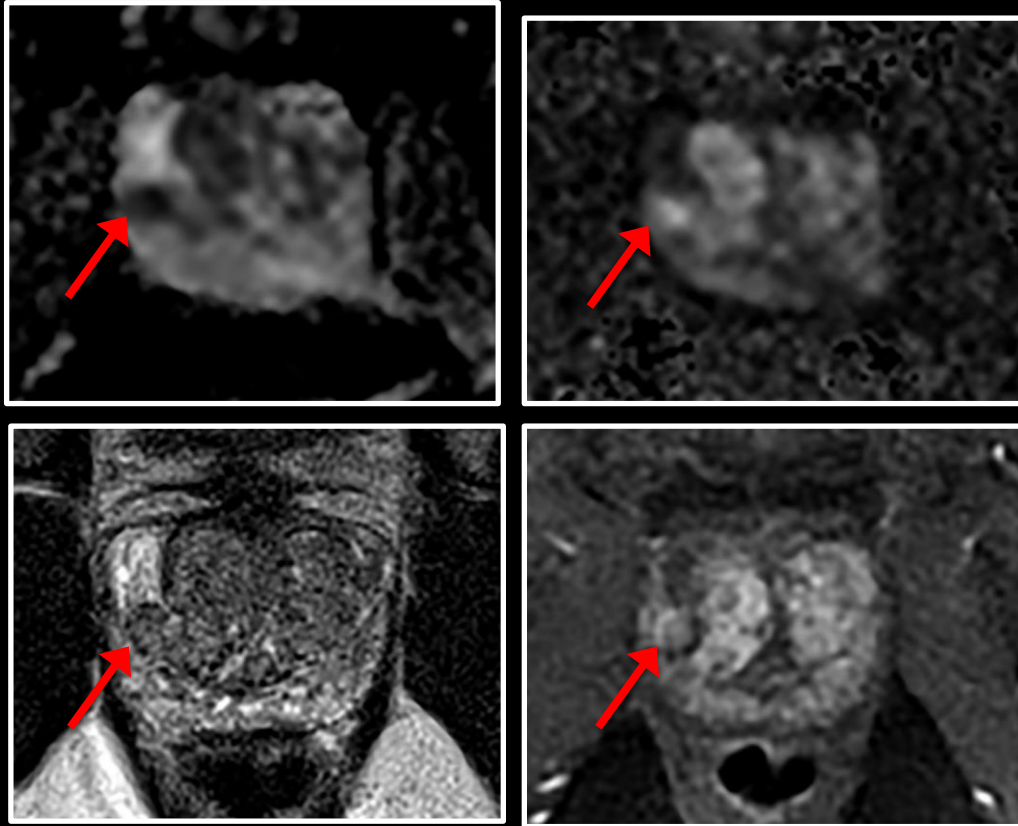
Stromal BPH nodule



Extruded BPH nodule



Extruded BPH nodule

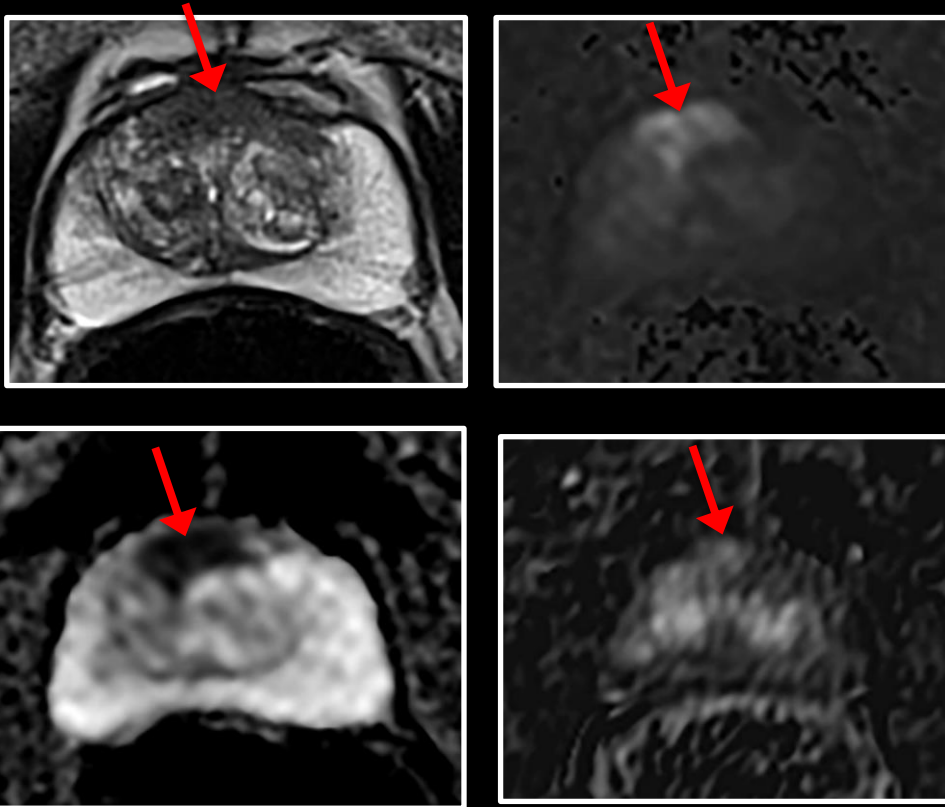


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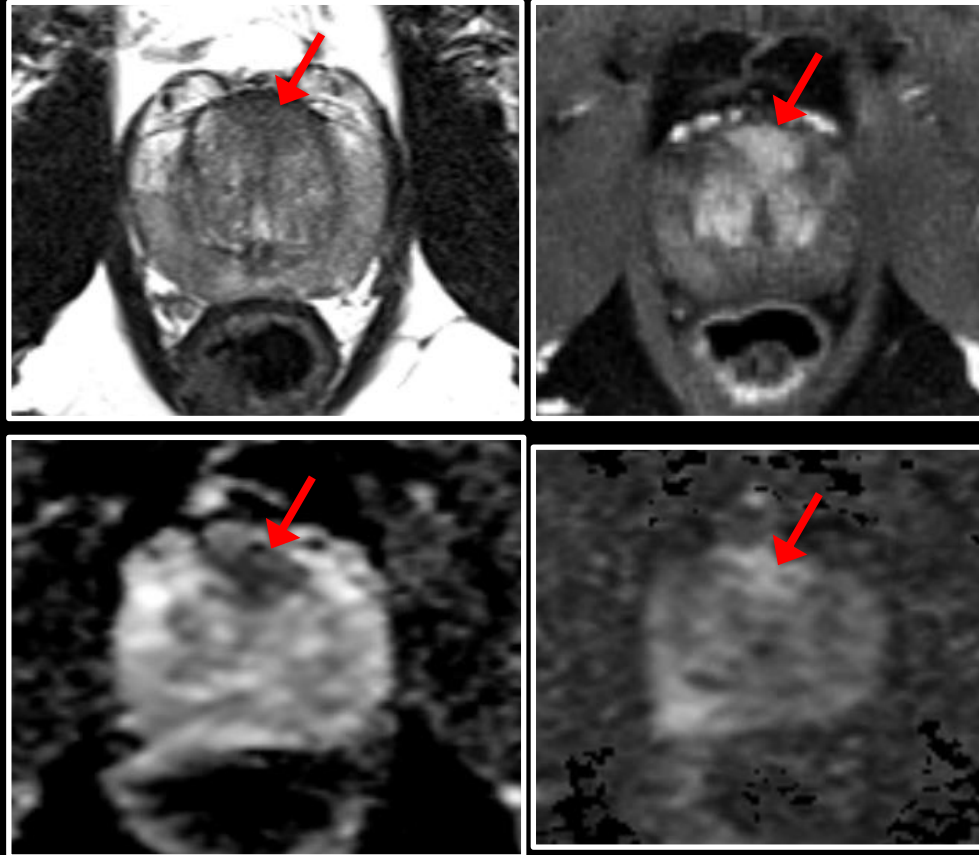
Anterior stromal tumor

- Homogeneous decreased T2 signal
- Tear-drop shaped; infiltrative margins
- Moderate-to-marked decreased ADC
- Increased signal on high b-value images
- Early enhancement

Anterior stromal tumor



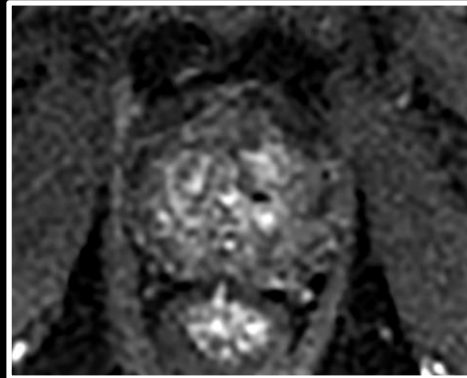
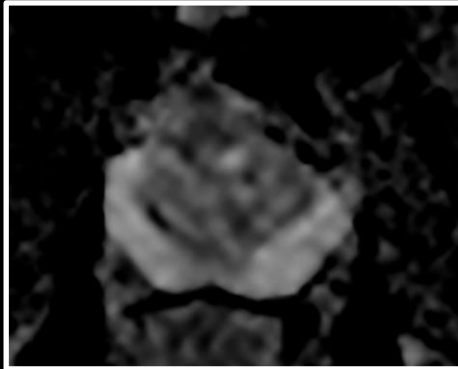
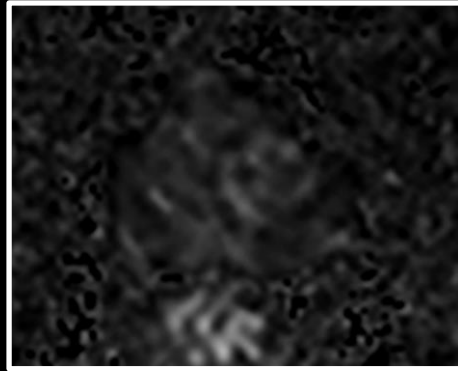
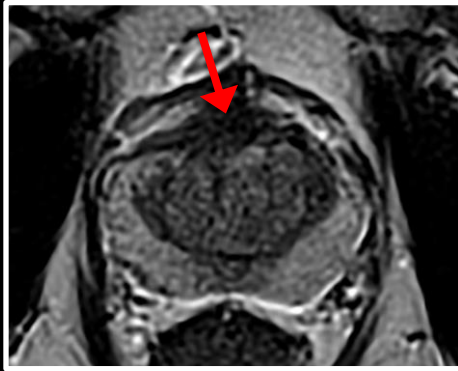
Anterior stromal tumor



Benign thickening of anterior stroma

- Symmetric abnormality at midline anterior prostate
- Diffuse mild reduction in ADC
- Hypovascular
 - No focal early enhancement

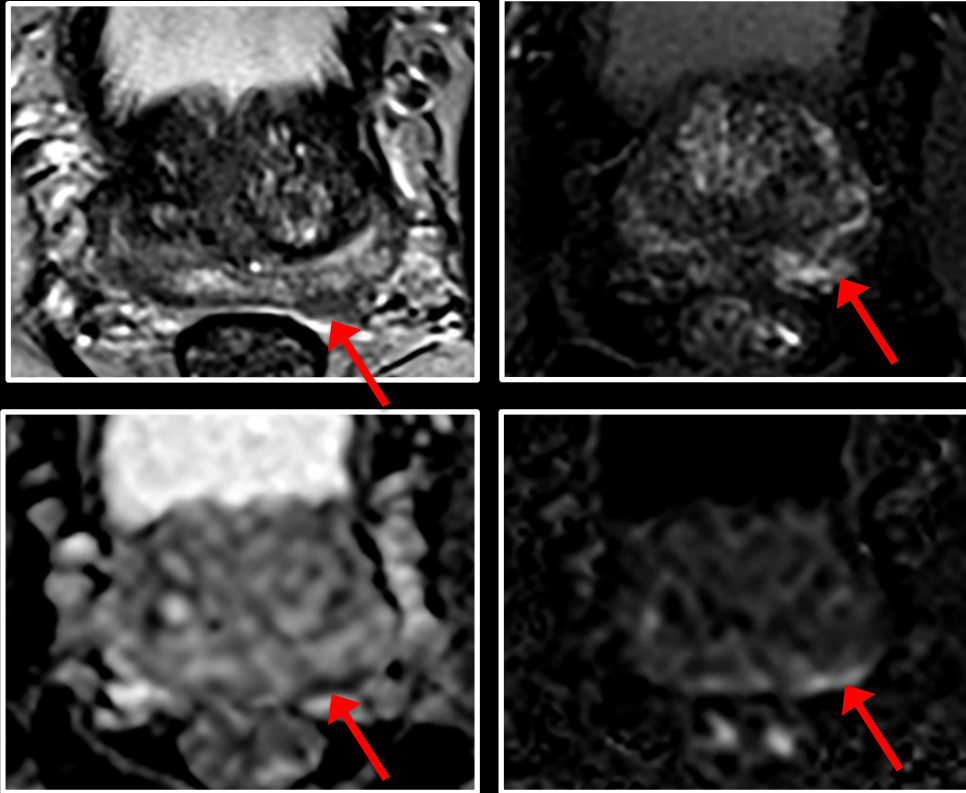
Benign thickening of anterior stroma



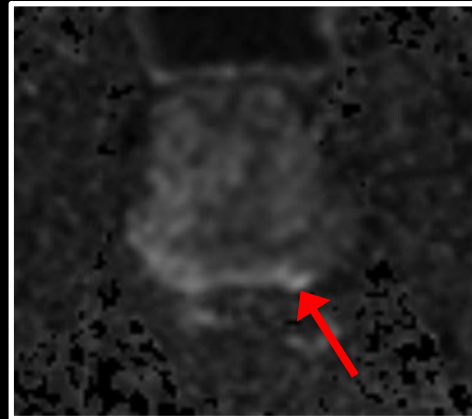
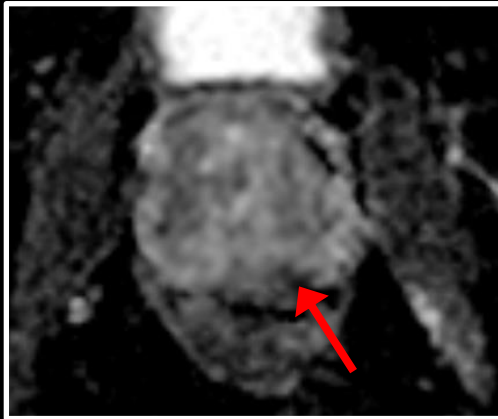
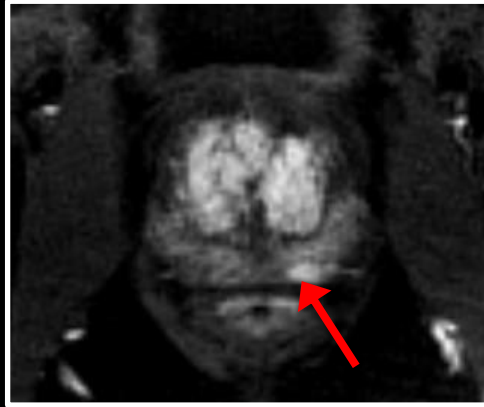
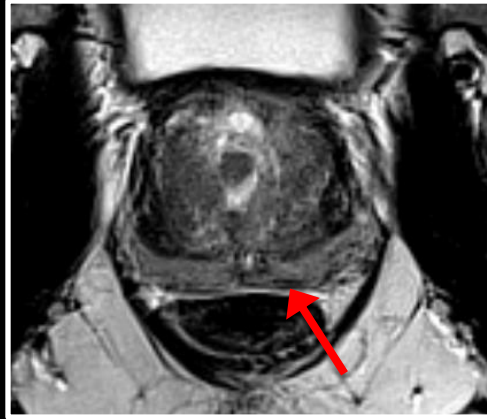
Subcapsular crescentic tumor

- Potentially subtle tumor growth pattern with a subcapsular crescentic distribution
- May be difficult to discern from capsule itself on T2WI
- DWI/DCE critical

Subcapsular crescentic tumor



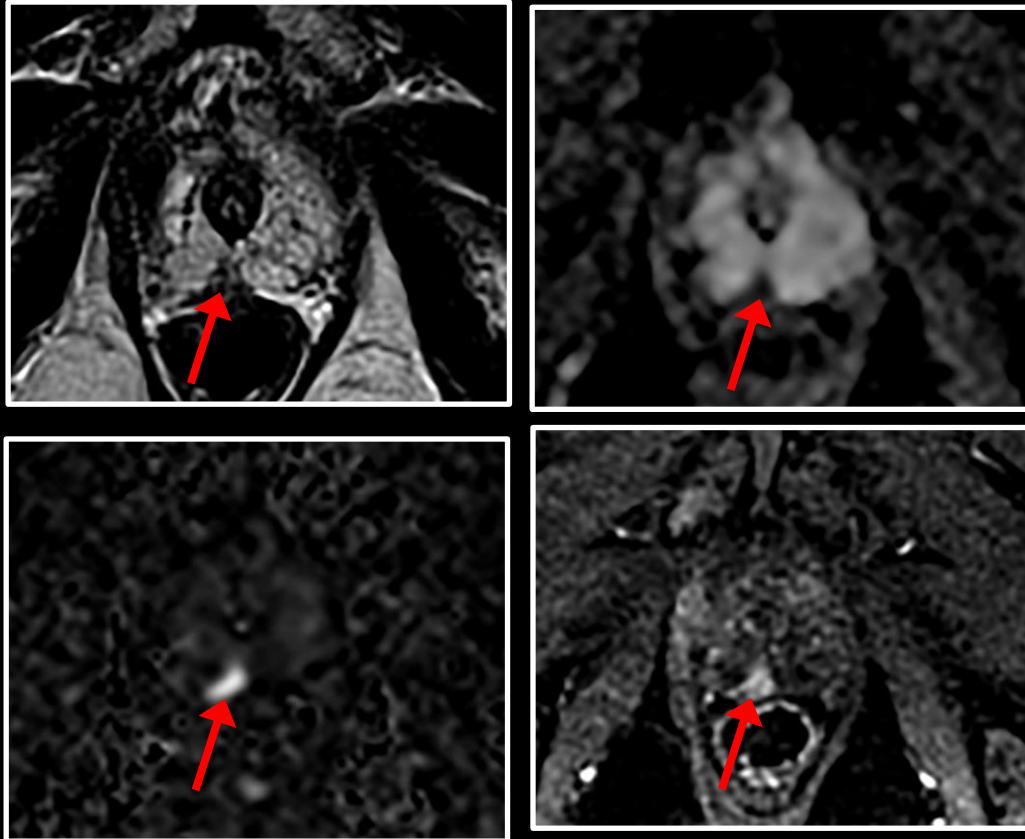
Subcapsular crescentic tumor



Distal apical tumor

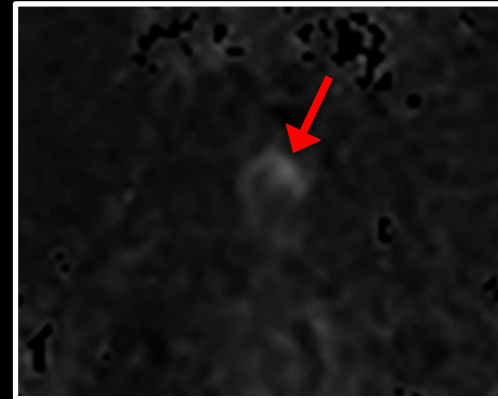
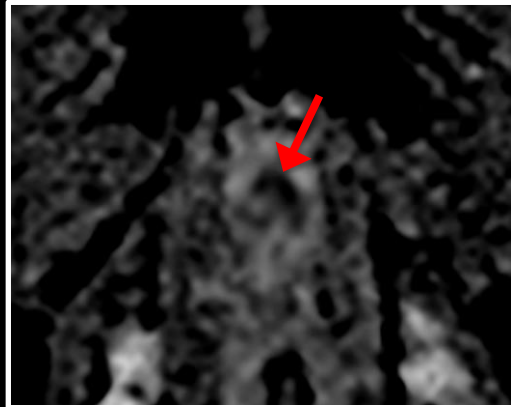
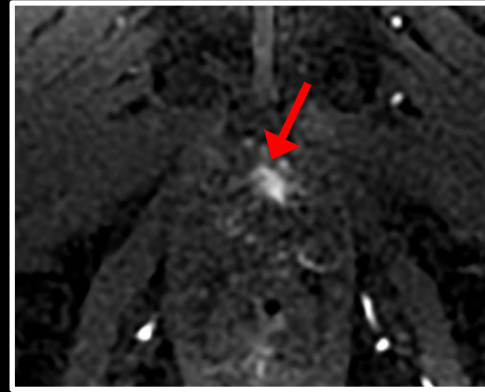
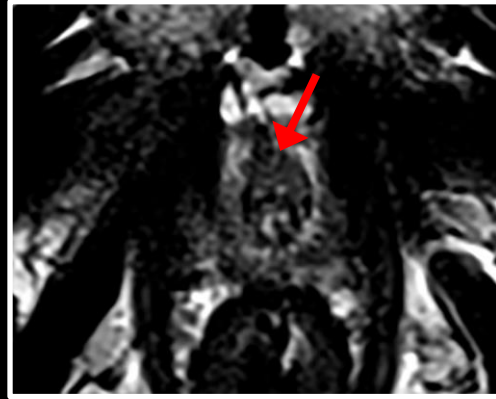
- Difficult region to reliably sample at biopsy
- Also may be difficult site to evaluate on MRI
- No clear apical capsule or margin to prostate on T2WI, confounding interpretation
- DWI/DCE critical

Distal apical tumor



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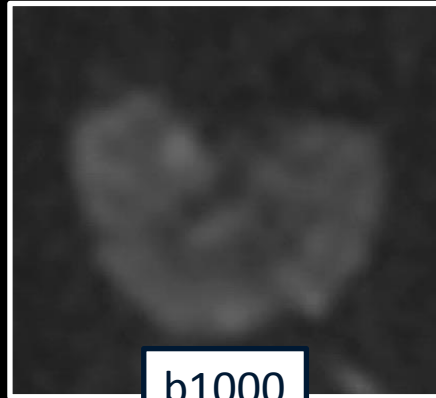
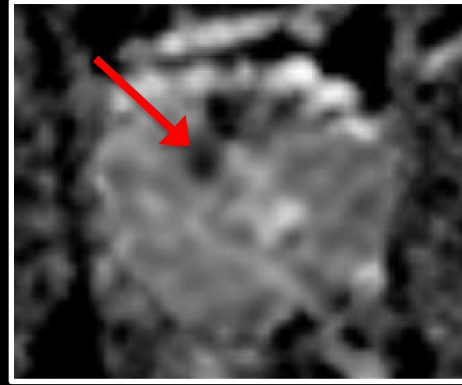
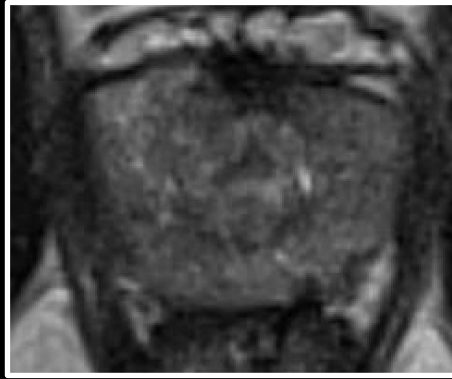
Distal apical tumor



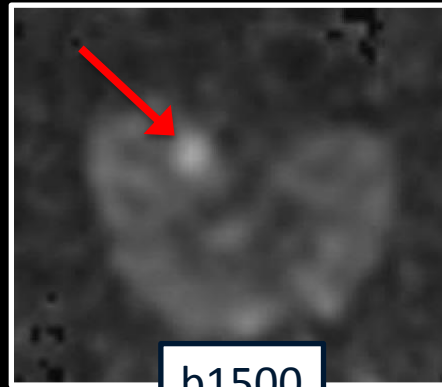
Use of very high b-values

- b-values in range of 1,400-2,000 s/mm²
- Can be directly acquired or computed from lower b-values
- Greater suppression of benign tissue at higher b-values may increase tumor conspicuity
- Advised by PI-RADS v2; supported in literature for both PZ and TZ tumor detection

Use of very high b-values

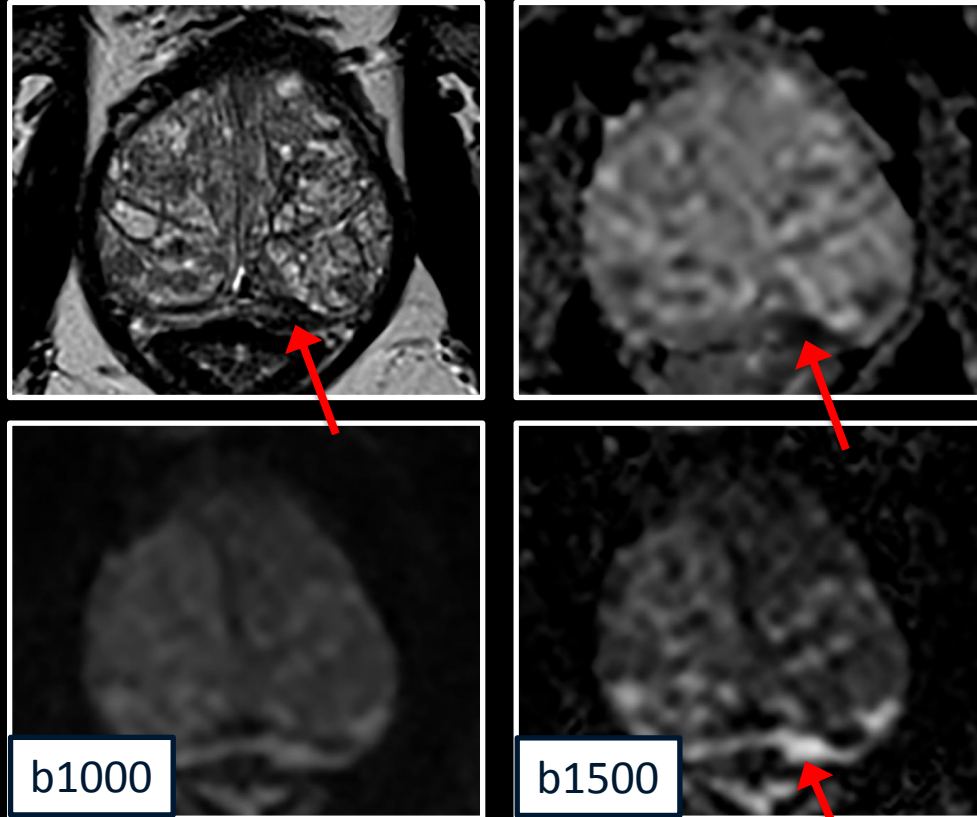


b1000



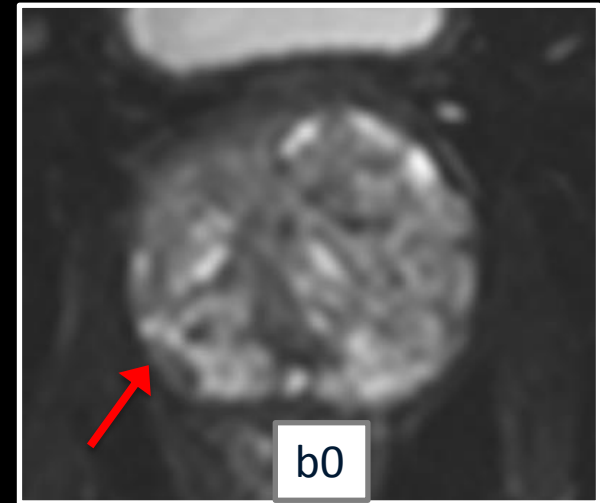
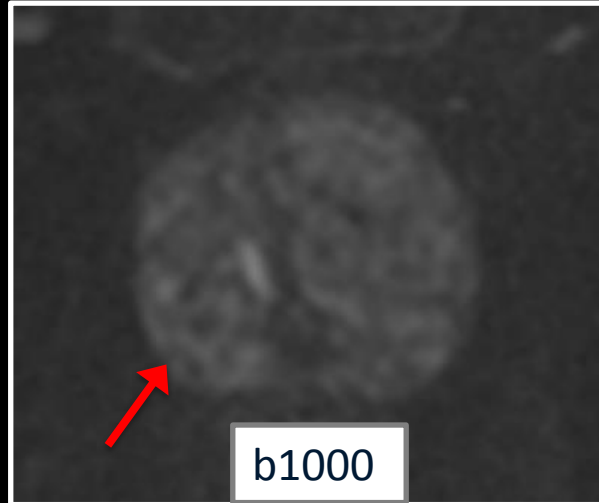
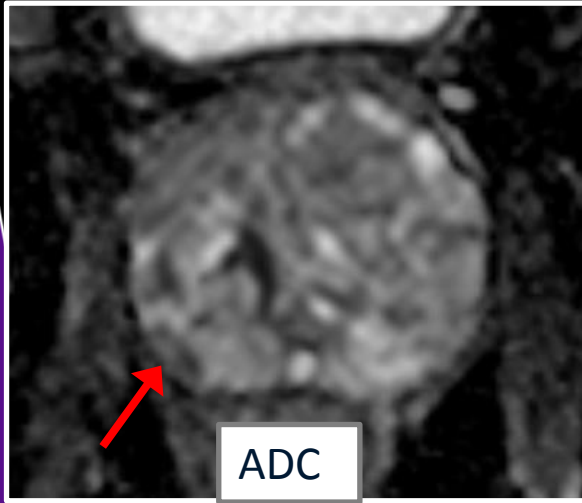
b1500

Use of very high b-values



T2 “blackout” effect

If area dark on b0 image, then will also be dark on high b image and on ADC map.



Conclusion

- Beware of normal structures and benign pathologies that can mimic tumor.
- Beware of tumors in subtle locations (subcapsular, distal apex, anterior stroma).
- Use all available image sets (multiplanar T2WI, various b-values, subtraction DCE).
- Sometimes will not be able to reliably differentiate tumor from a benign mimic, such that biopsy and/or follow-up will be needed.