Pitfalls in Prostate MRI

Andrew B. Rosenkrantz MD
Associate Professor of Radiology and Urology
Director of Prostate Imaging
Director of Health Policy
NYU Langone Medical Center
Disclosures

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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

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

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

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
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

Prostatitis

1-year follow-up
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
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
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
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
Distal apical tumor
Use of very high b-values

- b-values in range of 1,400-2,000 s/mm$^2$
- 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.