Pitfalls of Prostate MRI Interpretation

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Prostate Image Quality (PI-QUAL) score 5

"PI-RADS 4 Lesion in the right mid posterolateral PZ"
Prostate Image Quality (PI-QUAL) score 5
• To review some of the important caveats in interpretation of mpMRI of the prostate listed on PI-RADS v2.1
• Post-biopsy hemorrhage
• Prostatitis
• Benign Prostatic Hyperplasia (BPH)
• Central Zone (CZ)
• Anterior fibromuscular stroma (AFS)
Post-biopsy hemorrhage

- Can last for weeks to months
- ↑ T1 signal
- Prostate ↑ citrate
- PCa ↓ citrate
  - Hemorrhage exclusion sign
- 6-week interval between bx and MRI is suggested
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Prostatitis

- Common cause of PSA elevation and LUTS
- Etiologies
  - Bacterial prostatitis
  - Granulomatous prostatitis (GP)
- Can cause signal abnormalities in the PZ and TZ that mimic the appearance of PCa in all pulse sequences
- Morphology and degree of signal abnormality may be helpful to differentiate from PCa
Prostatitis

- Usually **mild** signal changes on T2 and DWI
- DCE: early arterial enhancement
- Focal
  - Lobar, wedge-shaped, linear, indistinct margin
- Diffuse

+FH of PCa, PSA 2.9. No prior Bx SBx: acute inflammation
Prostatitis

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- Focal
  - Lobar, wedge-shaped, linear, indistinct margin
- Diffuse

Elevated PSA, No prior Bx
MRI-targeted Bx: PCa GS 3 + 4

About 10% of cancers had wedge-shaped or linear morphology in an RP series (Abreu-Gomez J et al. AJR 2020 PMID: 32228325)
Prostatitis

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• DCE: early arterial enhancement
• Focal
  ➢ Lobar, wedge-shaped, linear, **indistinct margin**
• Diffuse

PCA (GS 3 + 3) on AS; PSA: 4.6
SBx: GS 3 + 3; chronic inflammation and atrophy
Prostatitis

- Usually mild signal changes on T2 and DWI
- DCE: early arterial enhancement
- Focal
  - Lobar, wedge-shaped, linear, indistinct margin
- Diffuse

PSA 5.68; No prior bx SBx: Acute inflammation
Prostatitis

- Usually mild signal changes on T2 and DWI
- DCE: early arterial enhancement
- Focal
  - Lobar, wedge-shaped, linear, indistinct margin
- Diffuse

PCa (3 + 3) on AS; PSA 5.2
MRI-targeted Bx: PCa GS 3 + 4
Prostatitis

• Usually mild signal changes on T2 and DWI
• DCE: early arterial enhancement
• Focal
  ➢ Lobar, wedge-shaped, linear, indistinct margin
• Diffuse

PSA: 122; No prior Bx
SBx: PCa GS 4 + 5 (all sextants)
Prostatitis

- Usually mild signal changes on T2 and DWI
- DCE: early arterial enhancement
- Focal
  - Lobar, wedge-shaped, linear, indistinct margin
- Diffuse

PSA: 6.7; No prior Bx
SBx: PCa GS 4 + 3 (all sextants)
Prostatitis

- Uncommon complication
- Restricted diffusion in areas with high/intern signal on T2-WI
- DCE: rim-enhancement
- Single or multiple
- PZ, TZ, or both

PSA 5.68; No prior bx SBx: Acute inflammation
Prostatitis

- Uncommon complication
- Restricted diffusion in areas with high/intern signal on T2-WI
- DCE: rim-enhancement
- Single or multiple
- PZ, TZ, or both
Prostatitis

- Granulomatous Prostatitis
  - Idiopathic
  - Granulomatous infection
    - BCG therapy for BCa, fungal infection
  - Other granulomatous diseases (e.g. Sarcoid, Wegner’s)
- More intense signal changes
- Small granulomas and “abscesses”
- Bx may be required

PSA: 7; +DRE; No prior Bx
MRI-targeted Bx: GP
Prostatitis

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BCa s/p BCG
PSA: 5.8; No prior Bx
MRI-targeted Bx: GP
Prostatitis

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  - Idiopathic
  - Granulomatous infection
    - BCG therapy for BCa, fungal infection
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- More intense signal changes
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BCa s/p BCG
PSA: 8.1; No prior Bx
MRI-targeted Bx: GP
Prostatitis

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  - Idiopathic
  - Granulomatous infection
    - BCG therapy for BCa, fungal infection
  - Other granulomatous diseases (e.g. Sarcoid, Wegner’s)
- More intense signal changes
- Small granulomas and “abscesses”
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Wegner’s; urinary retention
No PSA or prior Bx

T2
DCE
ADC
DWI
Prostatitis

- Granulomatous Prostatitis
  - Idiopathic
  - Granulomatous infection
    - BCG therapy for BCa, fungal infection
  - Other granulomatous diseases (e.g. Sarcoid, Wegner’s)
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Wegner’s; urinary retention
No PSA or prior Bx

Pre- and post-treatment with Prednisone and Rituximab
• Common in men aged 40 and above

• Hyperplasia of TZ with formation of nodules containing variable amounts of:
  - Glandular proliferation
  - Fibromuscular proliferation of the stroma
    • Prominent sclerotic, fibrous, or muscular elements
    • Low T2W SI, Restricted diffusion and/or focal contrast enhancement

• Rarely may contain foci of clinically significant cancer
BPH

- Homogeneous or heterogeneous T2W signal
- Morphologic features:
  - Round/oval
  - Well-circumscribed
  - Encapsulated
  - “Atypical”
  - Symmetric
- May insinuate into the PZ

PSA: 8.9; SBx: negative
BPH

• Homogeneous or heterogeneous T2W signal
• Morphologic features:
  ➢ Round/oval
  ➢ Well-circumscribed
  ➢ Encapsulated
  ➢ “Atypical”
  ➢ Symmetric
• May insinuate into the PZ

PSA: 12; SBx: negative
BPH

• Homogeneous or heterogeneous T2W signal
• Morphologic features:
  ➢ Round/oval
  ➢ Well-circumscribed
  ➢ Encapsulated
  ➢ “Atypical”
  ➢ Symmetric
• May insinuate into the PZ

PSA 11; SBx: negative
MRI-targeted Bx: PCa GS 3 +3

T2 score 2 + DWI score 4 -> PI-RADS score 3
BPH

- Homogeneous or heterogeneous T2W signal
- Morphologic features:
  - Round/oval
  - Well-circumscribed
  - Encapsulated
  - “Atypical”
  - Symmetric
- May insinuate into the PZ

PSA 6.7; SBx: negative x 2
MRI-targeted Bx: PCa GS 4 +3
BPH

PI-RADS 1

PI-RADS 5
BPH

- Homogeneous or heterogeneous T2W signal
- Morphologic features:
  - Round/oval
  - Well-circumscribed
  - Encapsulated
  - “Atypical”
  - Symmetric
- May insinuate into the PZ

PSA 7.2; SBx: negative
BPH

• Homogeneous or heterogeneous T2W signal
• Morphologic features:
  ➢ Round/oval
  ➢ Well-circumscribed
  ➢ Encapsulated
  ➢ “Atypical”
  ➢ Symmetric
• May insinuate into the PZ

Abnl DRE and PSA 5.8 SBx: negative
BPH

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- Morphologic features:
  - Round/oval
  - Well-circumscribed
  - Encapsulated
  - “Atypical”
  - Symmetric
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BPH

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- Morphologic features:
  - Round/oval
  - Well-circumscribed
  - Encapsulated
  - “Atypical”
  - Symmetric
- May insinuate into the PZ

78 yo, PSA 10.0 
MRI-guided bx: PCa GS 4 + 4

Turkbey B et al. PI-RADS: What’s Next? Radiology, 2023
Central Zone

- Conical-shaped layer of tissue around the ejaculatory ducts that extends from base down to the verumontanum
- Contains more stroma than glandular tissue
- Visible on MRI in ~80% of cases
**Central Zone**

- Low SI on T2-WI and ADC at the base
- **Symmetric** (~80%)
- CZ tumors:
  - Higher PSA, GS, and rates of EPE and SVI
  - Focal asymmetries and early enhancement
Central Zone

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- Symmetric (~80%)
- CZ tumors:
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PCa (GS 3 + 3) on AS MRI-targeted Bx:
PCa GS 4 + 3
Central Zone

- Low SI on T2-WI and ADC at the base
- Symmetric (~80%)
- CZ tumors:
  - Higher PSA, GS, and rates of EPE and SVI
  - Focal asymmetries and early enhancement

PCa (GS 3 + 3) on AS
PSA: 26.3
MRI-targeted Bx:
PCa GS 3 + 4
Anterior Fibromuscular Stroma

- Variable thickness according to the degree of BPH.
- Low SI on T2 and ADC
- Low SI on DWI
- No early enhancement
- For cancer in the AFS use criteria from the zone where cancer originates
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- Low SI on T2 and ADC
- Low SI on DWI
- No early enhancement
- For cancer in the AFS use criteria from the zone where cancer originates

MRI-targeted Bx: PCa GS 3 + 4
Summary

- In the PZ, signal changes on T2W and/or DWI that are indistinct, linear, wedge-shaped, lobar, or diffuse are less likely to be malignant.
Summary

- Heterogeneous or homogeneous nodules that are round/oval, well-circumscribed, and encapsulated or symmetric should be considered to be BPH (PI-RADS 1)

Organized chaos
Symmetric
Insinuated BPH nodule
Summary

- CZ: **symmetric** tissue with low SI on T2WI and ADC extending from base to the **verumontanum**
Summary

- AFS: Anterior structure with low SI on T2 but with **no restricted diffusion or early enhancement**
Thank you!