

Prostate MRI: Pitfalls and Artifacts that can Mimic Disease

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Disclosures

- Nothing to disclose

Learning Objectives

- Describe common entities that can confound the interpretation of prostate MRI
- Classify these into anatomical structures, benign processes and technical artifacts
- Discuss how pitfalls can be avoided

Radiologist, Be Aware: Ten Pitfalls That Confound the Interpretation of Multiparametric Prostate MRI

Andrew B. Rosenkrantz and Samir S. Taneja

American Journal of Roentgenology 2014 202:1, 109-120



[Benign Conditions That Mimic Prostate Carcinoma: MR Imaging Features with Histopathologic Correlation](#)

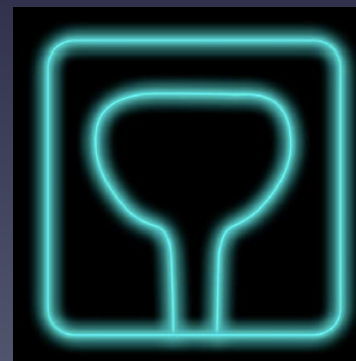
Yu Xuan Kitzing, Adilson Prando, Celi Varol, Gregory S. Karczmar, Fiona Maclean, and Aytakin Oto

RadioGraphics 2016 36:1, 162-175

Prostate cancer and its mimics at multiparametric prostate MRI

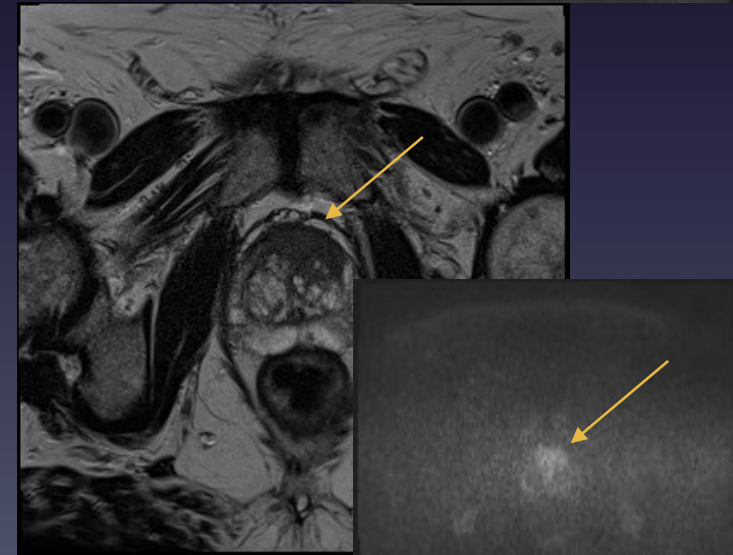
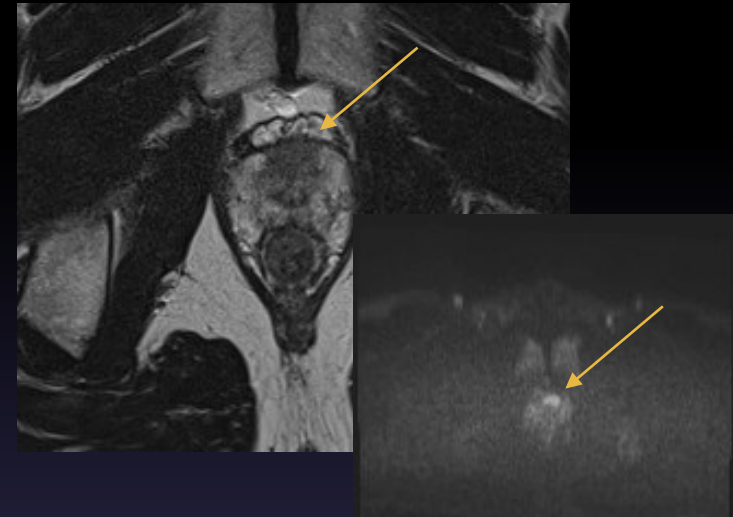
Yu J, Fulcher A S, Turner M A, Cockrell C H, Cote E P, and Wallace T J

The British Journal of Radiology 2014 87:1037



Appearance of Prostate Cancer on MRI

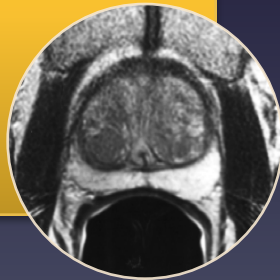
- Multi-parametric prostate MR combines anatomical and functional imaging
- Prostate Imaging Reporting and Data System, PIRADS v2
- Peripheral zone
 - Focal, low signal on ADC, bright on DWI, hypointense T₂
 - Abnormal enhancement may upgrade P₃ to P₄
- Transition zone
 - Lenticular or non-circumscribed hypointense nodule on T₂
 - DWI score of 5 can upgrade P₃ to P₄



Challenges in Prostate MRI

- Normal anatomy and benign pathology may mimic tumor
- Occult tumor – PZ tumors may be isointense on T2
- Low T2 in PZ is non-specific; DDX incl. Hg, prostatitis, scar, atrophy and post-Rx changes
- Heterogeneity in scanners, protocols and techniques across institutions

Imaging



- High prevalence of prostate ca, but may not be clinically significant
- Prostate ca can occur with normal PSA
- Elevated PSA not specific for prostate ca

Clinical



Challenges in Prostate MRI

Anatomic

- AFMS
- Surgical/pseudo Capsule
- Central Zone
- Periprostatic veins
- NV bundle
- Lymph nodes

Benign Processes

- BPH nodules
- Prostatitis
- Hemorrhage
- Atrophy
- Necrosis
- Calcification

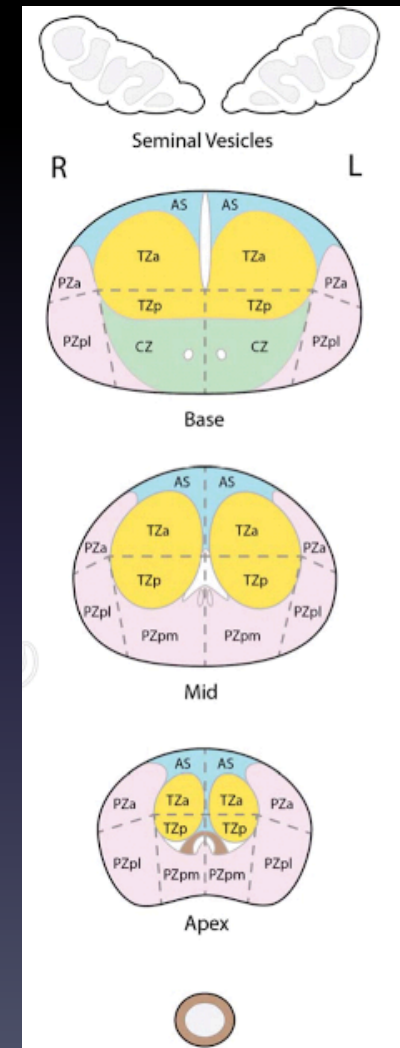
Technique

- DWI artifacts
- Motion
- ADC windowing
- ERC

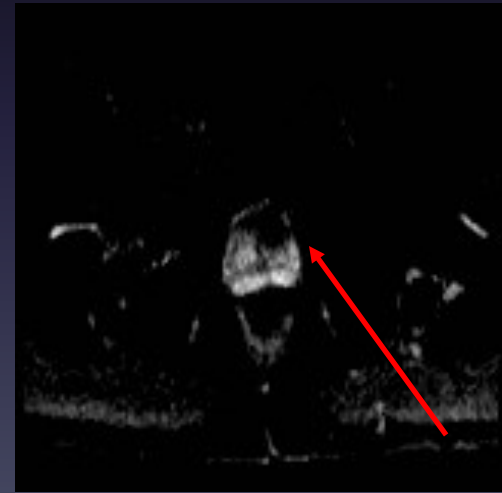
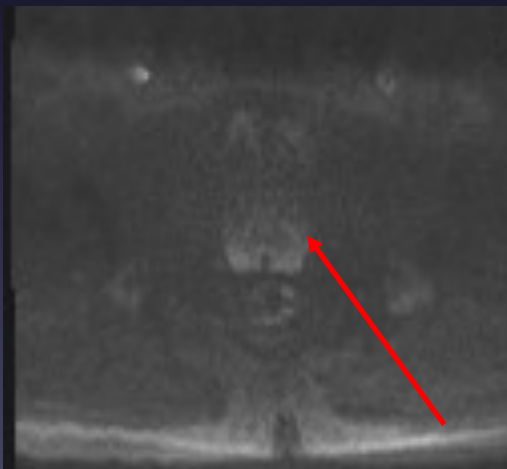
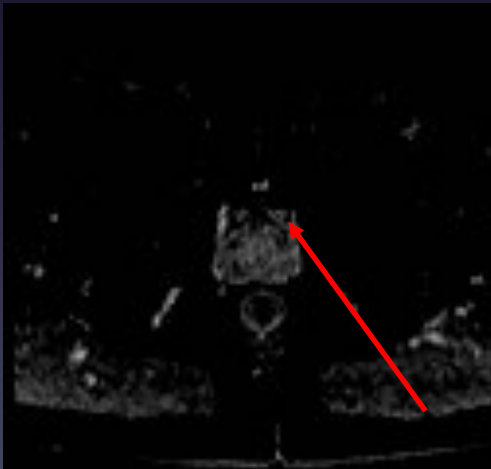
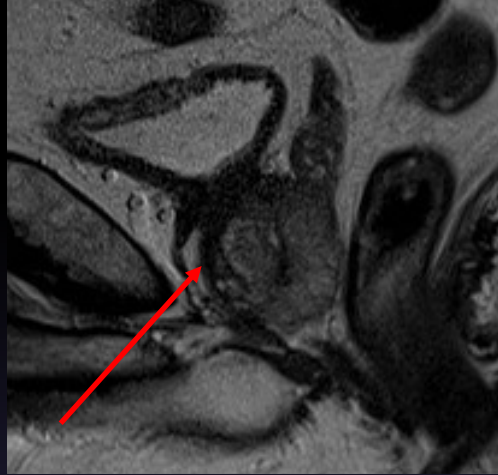
ANATOMIC

Anterior Fibromuscular Stroma

- Anterior/anterolateral margins of prostate
- Tightly packed muscle fibres, low T2 and low ADC
- Most pronounced in younger patients, decreases with age
- Distinguish from malignancy by typical location and symmetry

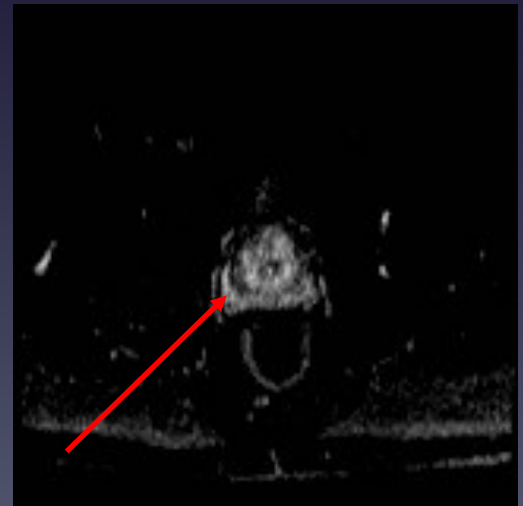


AFMS



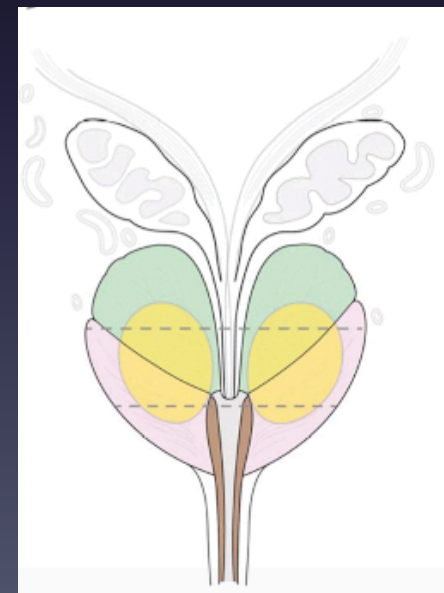
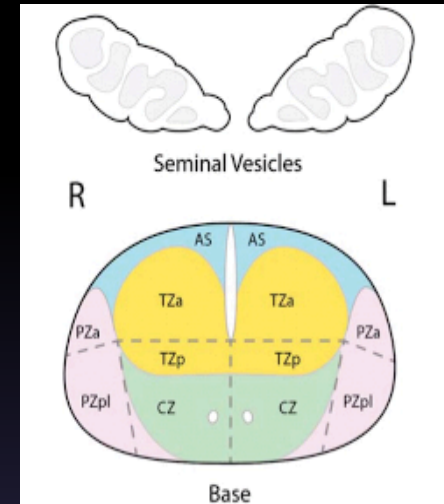
Surgical (pseudo) Capsule

- Separates PZ and TZ
- Centrally placed band of fibromuscular and compressed glandular tissue
- Low signal on T₂, low on ADC
 - Asymmetric thickening can mimic malignancy
 - Clue: location and elongated appearance
 - Enhancement normal, may help to differentiate from ca
- Poor definition can suggest underlying TZ cancer

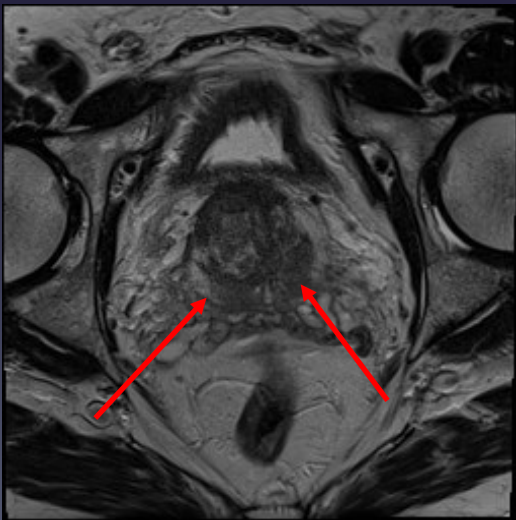
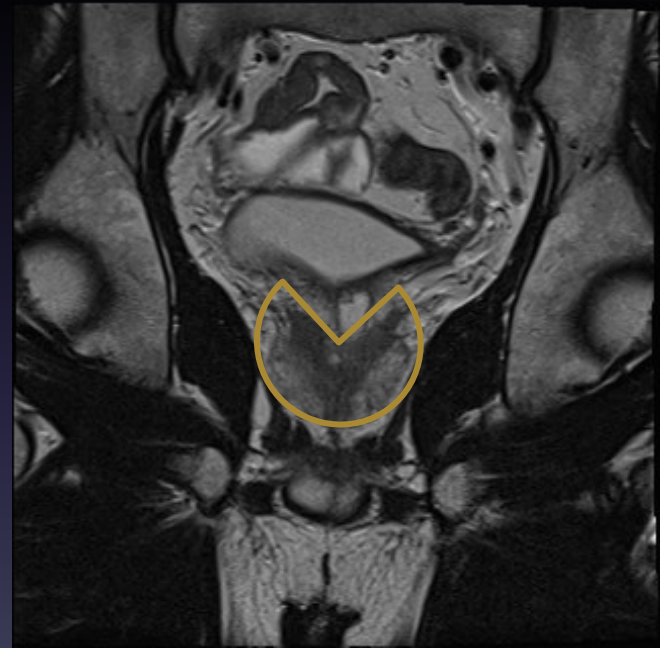
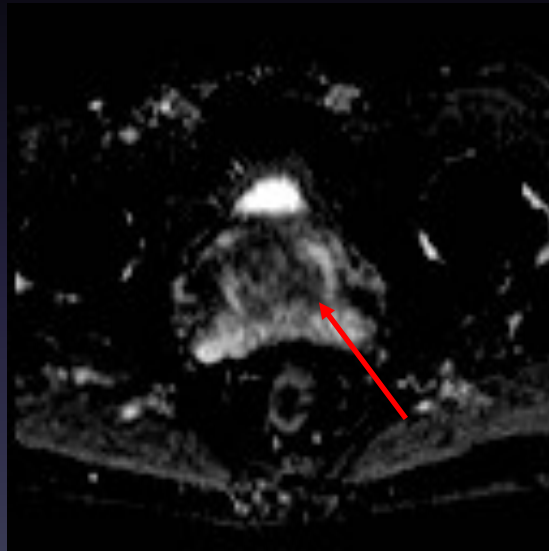
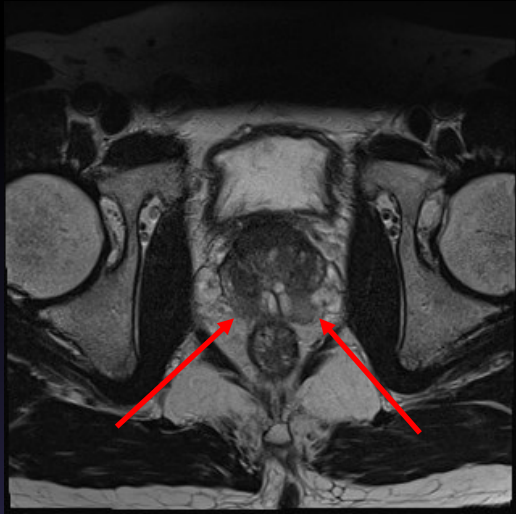


Central Zone

- Located posterior to TZ, surrounds ejaculatory ducts at base, extends inferiorly to verumontanum
- Complex crowded glands and dense stroma
- CZ accounts for 25% volume, decreases with age
- May be difficult to identify - especially in older patients
- Asymmetric in 20%
- Tumors here represent only 0.5-2.5% of all Prostate ca
 - Likely to be high grade with ECE and SV invasion (lack of low signal rim seen in BPH nodule, mass effect)
- CZ is low SI on T2 and ADC – can obscure or mimic tumor
- **Clue: "V" shape on coronal imaging**

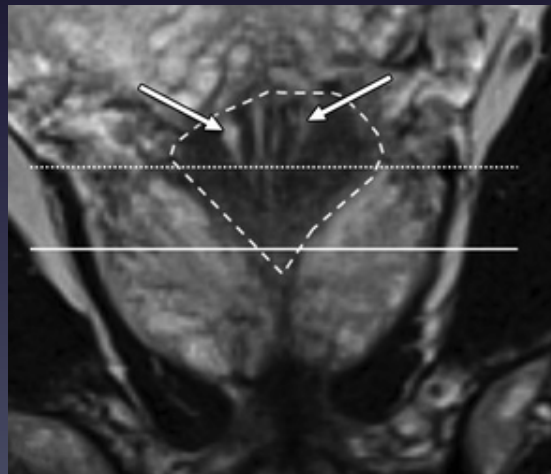
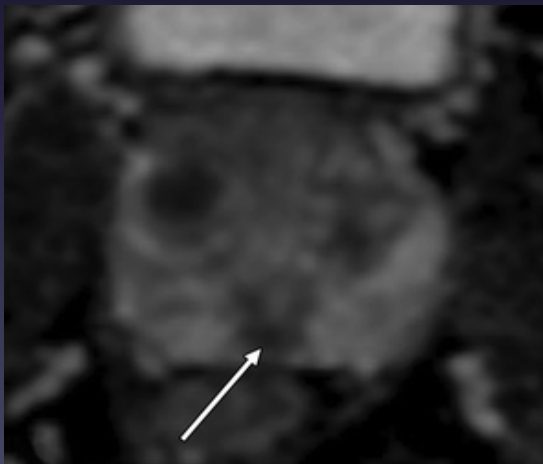
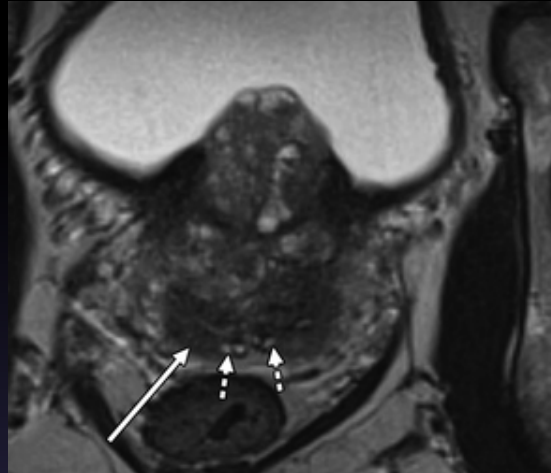
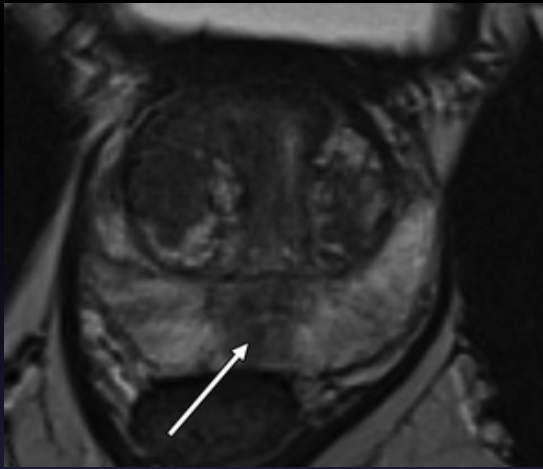


CZ

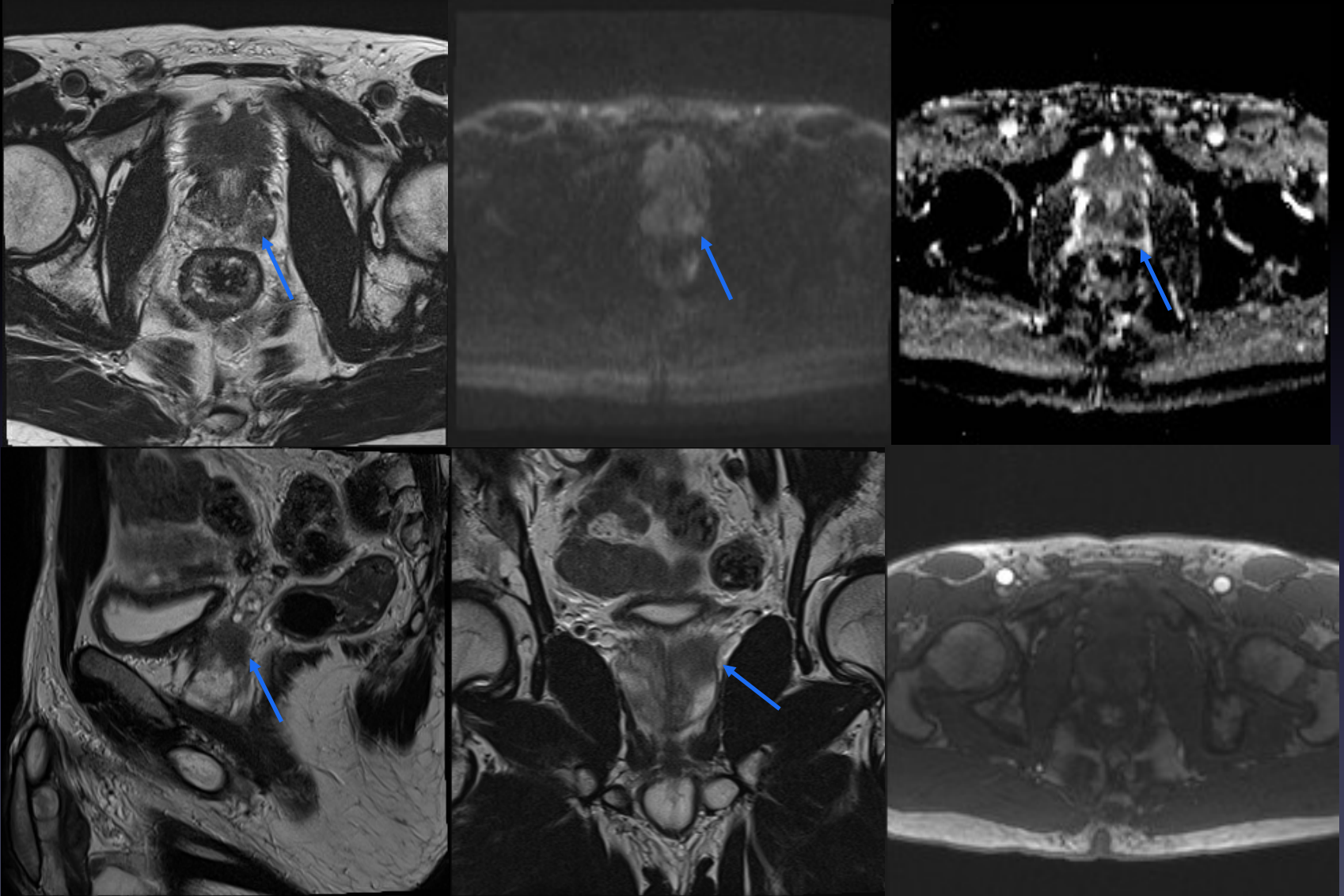


Pitfall

Central Zone



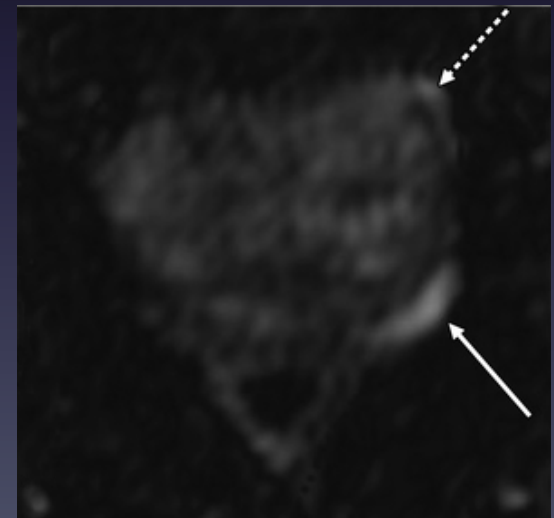
PIRADS 5 PZ, with ECE



Courtesy: Dr. Silvia Chang, VGH

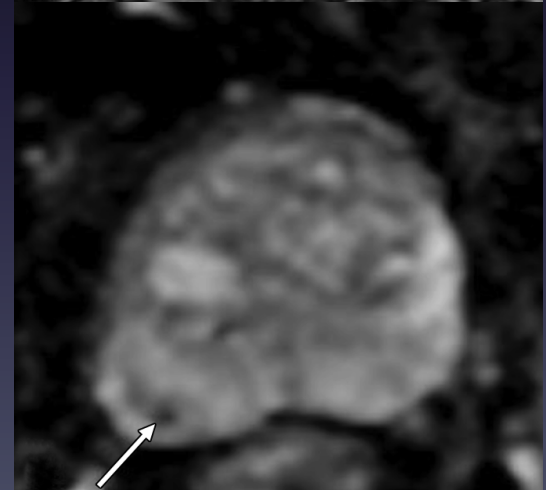
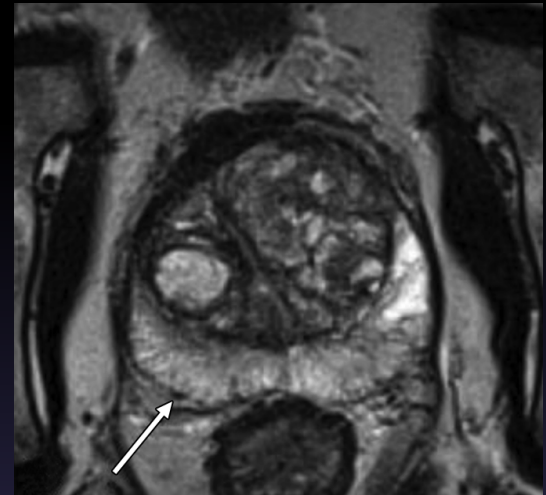
Periprostatic Veins

- Round tubular structures anterolateral to prostate
- Course laterally around prostate draining into internal iliac veins (Santorini venous plexus)
- Decreases in size with age
- Low signal T2 and ADC, mimics cancer especially at level of apex, can enhance avidly
- Distinguish by location and linear morphology



Neurovascular Bundle

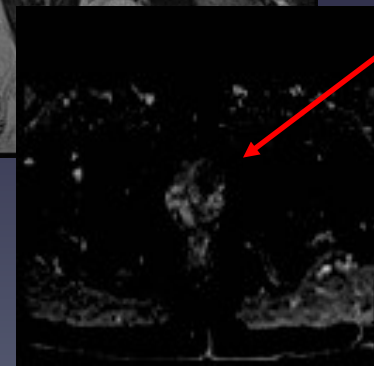
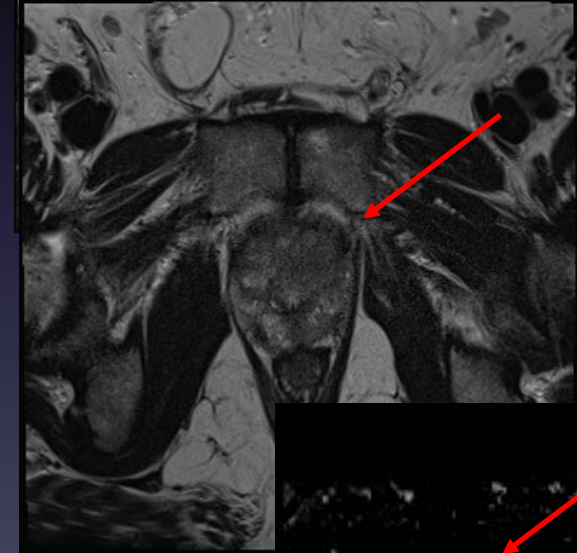
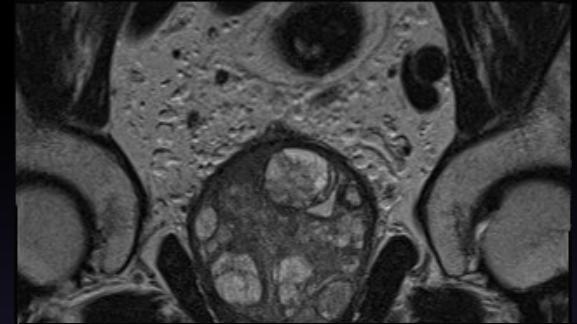
- Neural plexus, arteries and veins
- Posterolateral to prostate at 5 and 7 o'clock position
- Flow void on T2, dark on ADC, may appear round
- Tubular on contiguous slices – distinguishing from malignancy



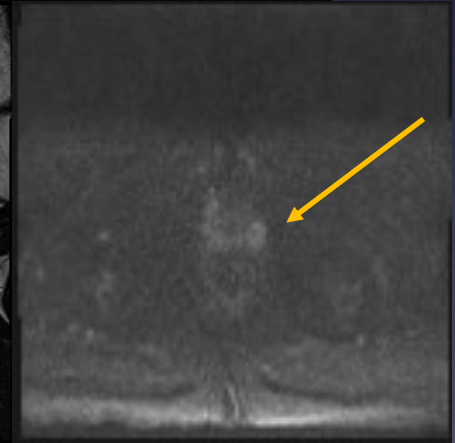
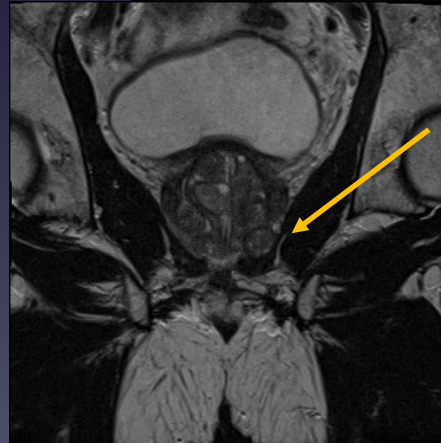
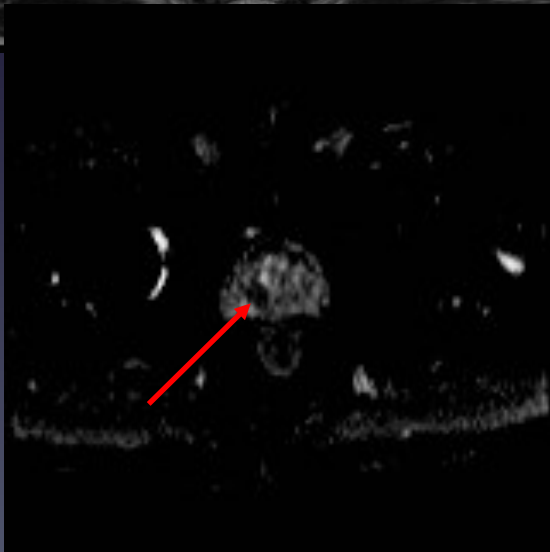
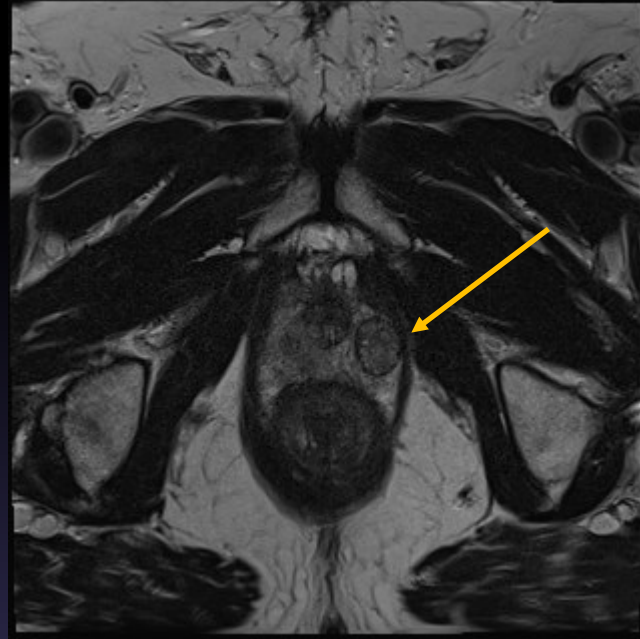
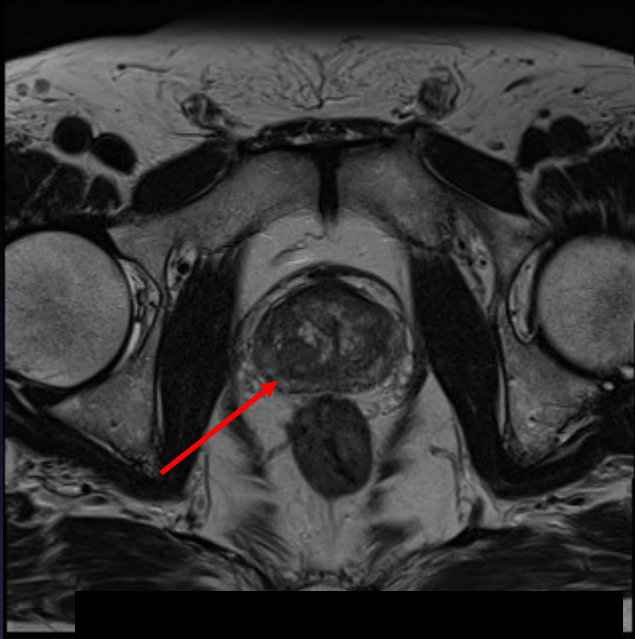
BENIGN PROCESSES THAT CAN MIMIC TUMOR

Benign Prostatic Hypertrophy

- BPH results in enlargement and heterogeneity of TZ
- BPH nodules variable signal
 - Glandular – bright on T2
 - Stromal – dark on T2, low ADC – mimic TZ cancer
 - Can extrude into PZ and mimic ca
- BPH nodules encapsulated, ADC values not as low
 - Cancers irregular margins, lenticular shape, erased charcoal

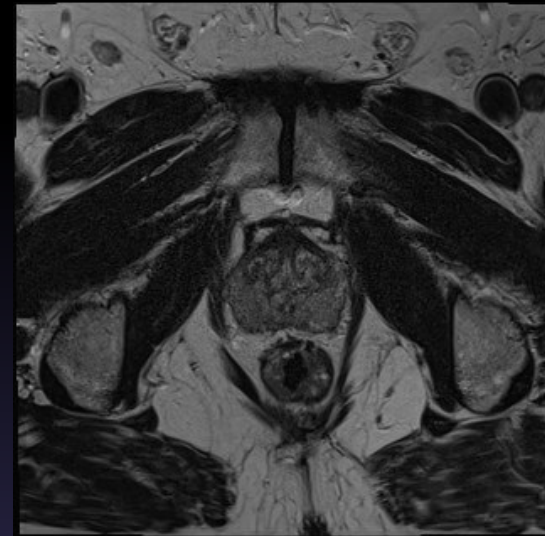


BPH

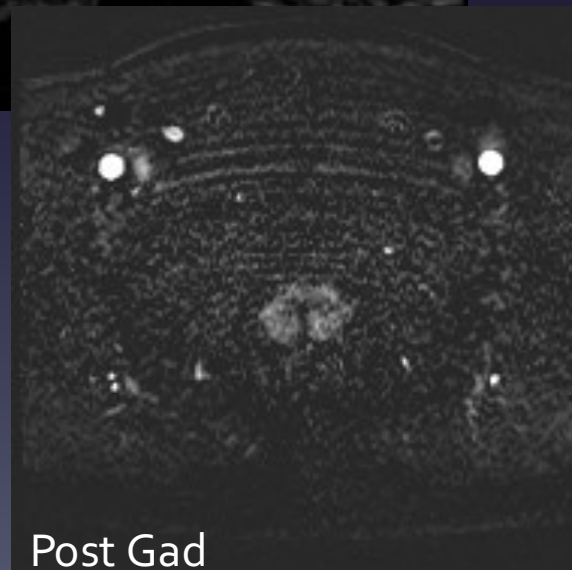
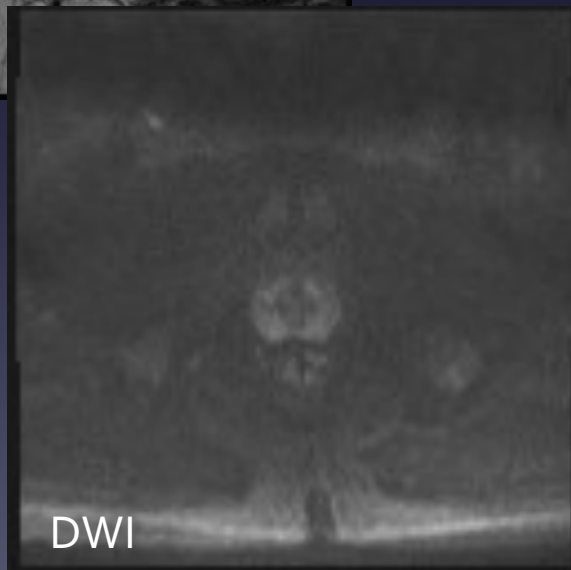
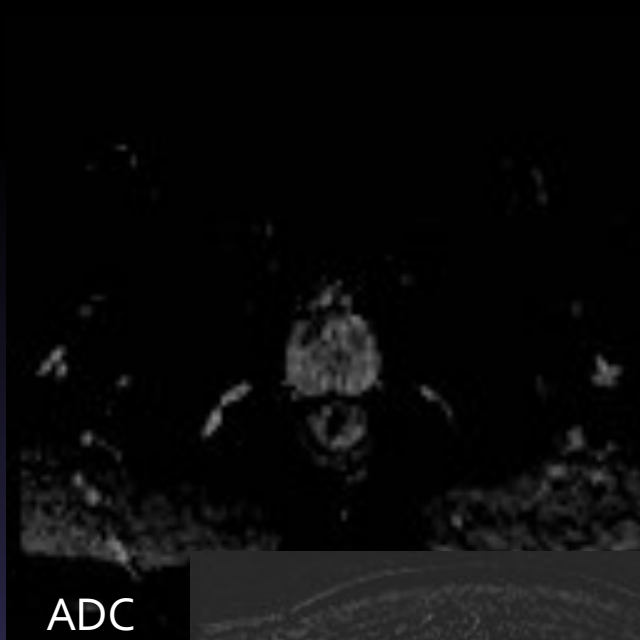
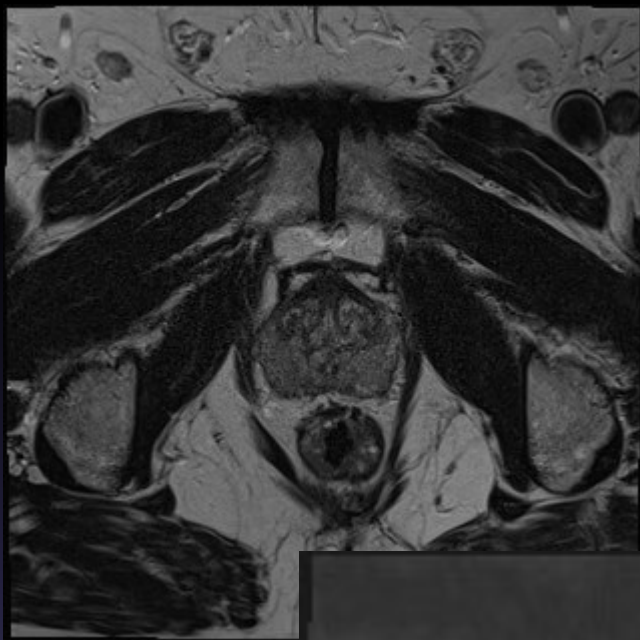


Prostatitis

- Common mimic of Prostate ca; acute or chronic
- Bacterial prostatitis – E.coli, Enterococcus, Proteus
 - More commonly PZ
- Focal or diffuse
- Low T₂, restricted diffusion, increased enhancement
- **Granulomatous prostatitis** – uncommon inflammatory condition – multiple etiologies (infection, iatrogenic, malakoplakia, systemic granulomatous disease, idiopathic)
- Can contain areas of necrosis and show ECE
- Cannot be reliably distinguished from malignancy with imaging alone

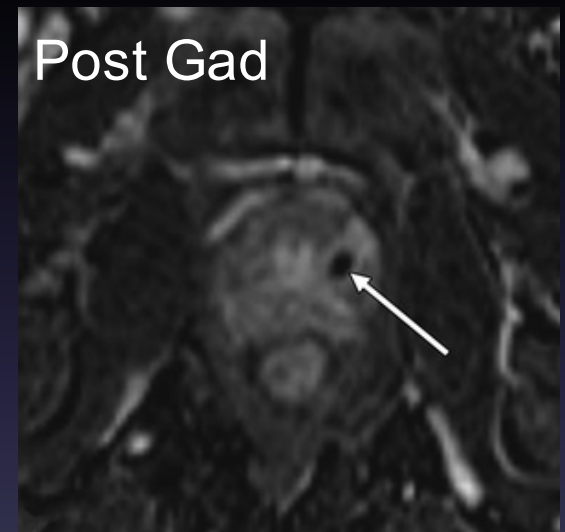
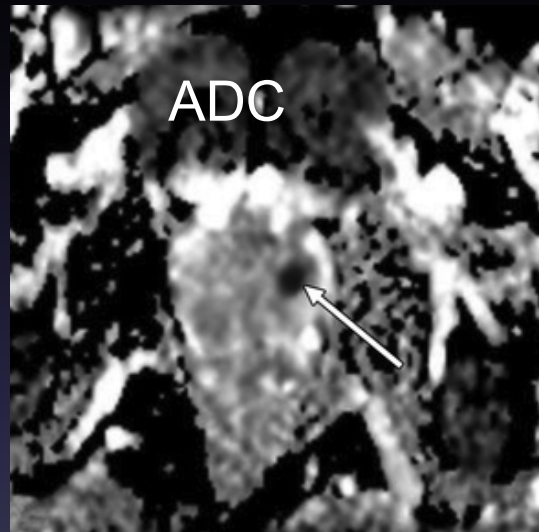
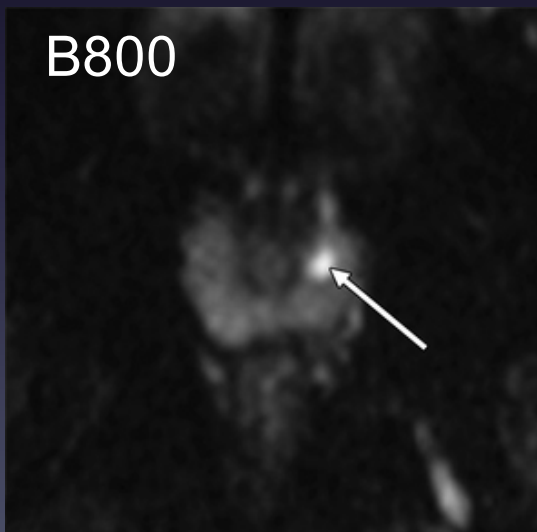
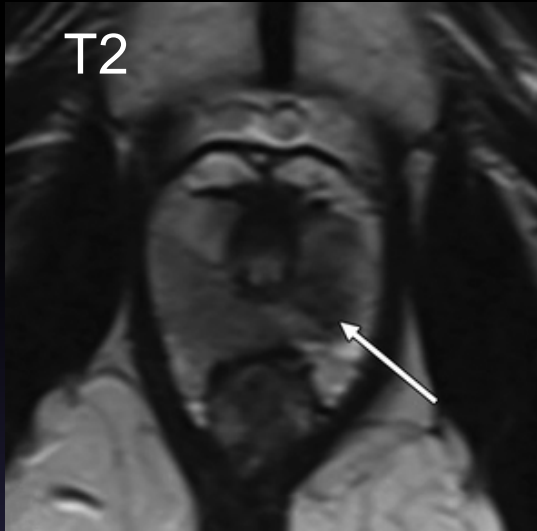


Prostatitis



Pitfall

Granulomatous Prostatitis



Hemorrhage

- Post biopsy; PZ > TZ
- Citrate – anticoagulant
- Typically wait at least 6 weeks
- Hg can resemble (low T₂, low ADC) or obscure tumor
- Correlate with patient history
- Clue: Hg is T₁ bright on fat-sat pre-contrast T₁WI
- Subtraction imaging helpful

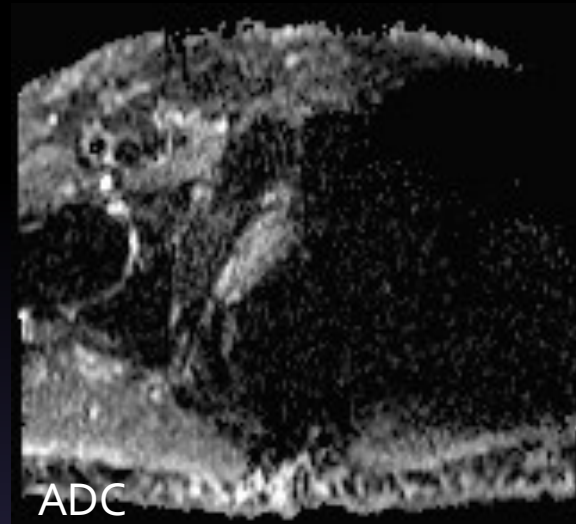
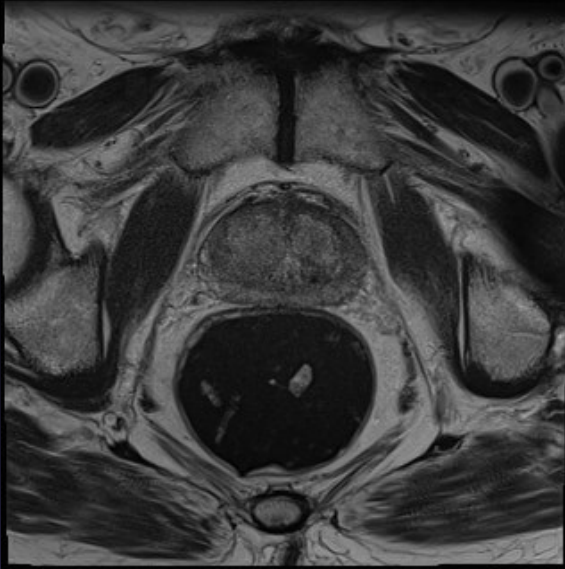


TECHNIQUE RELATED

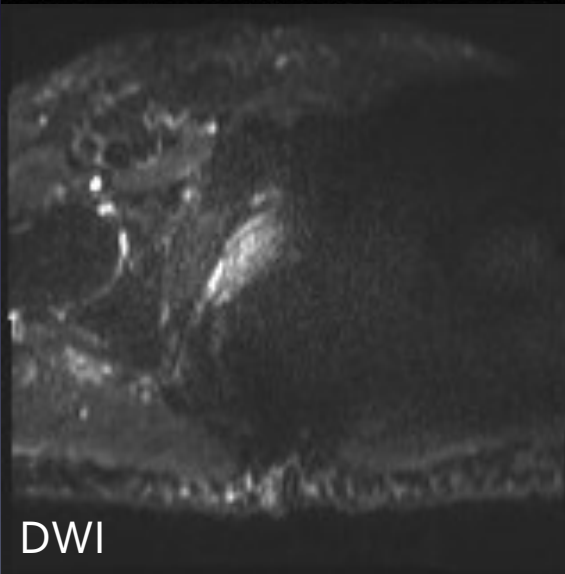
DWI

- Multiple false positives – BPH nodules, Hg etc
- Susceptibility artifacts – field inhomogeneities
 - Metal, THR
 - Gas in rectum
 - Endorectal coil – distortion, over inflation
- DWI has low SNR – higher b value-> longer scan time
- Variability in ADC values between scanners
- Lesion conspicuity affected by ADC windowing - 1400/1400

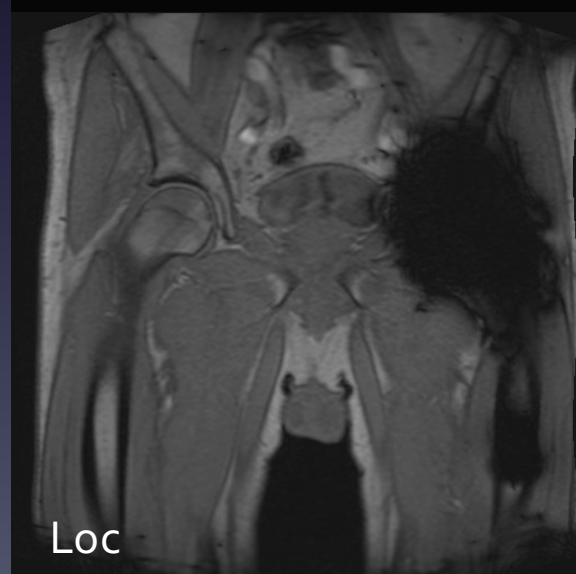
THR



ADC

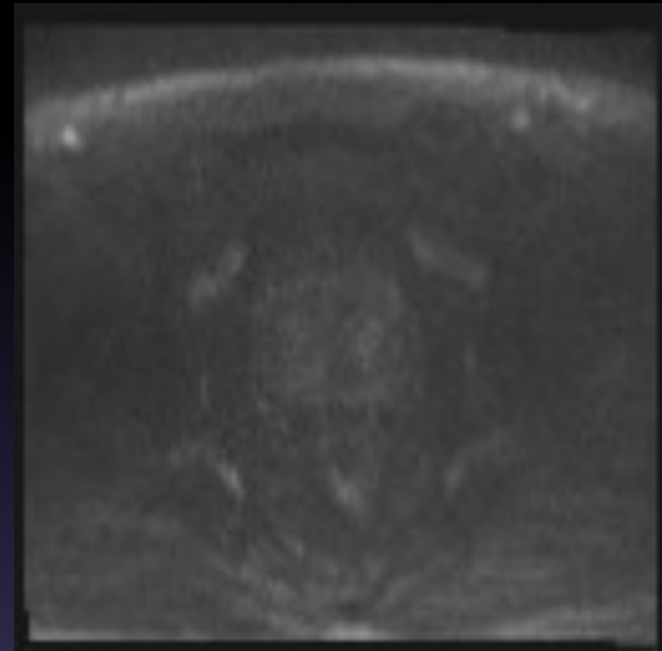
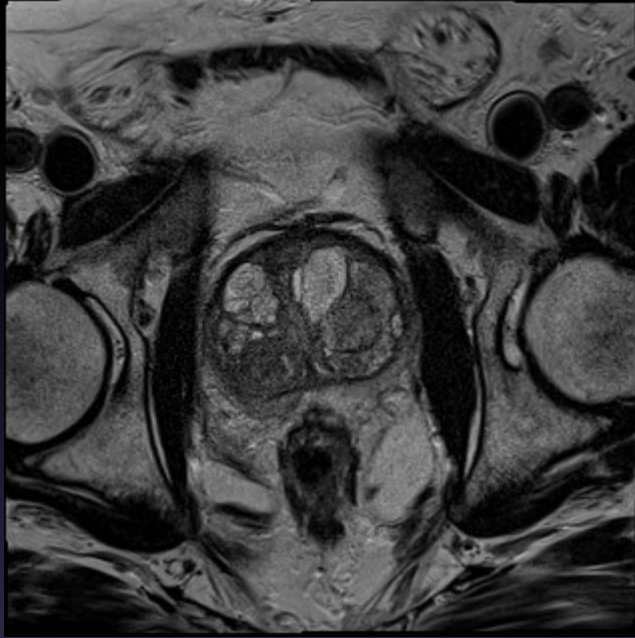


DWI

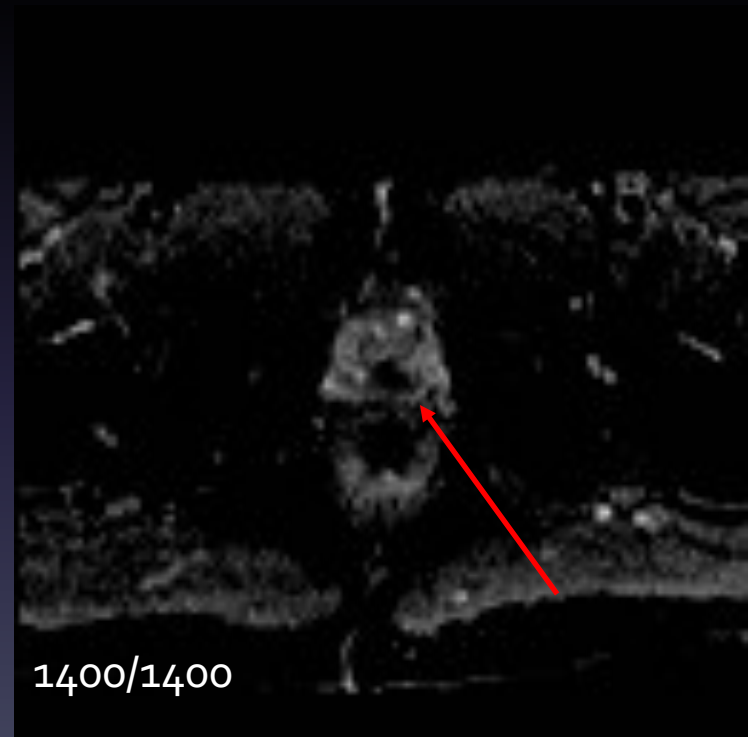
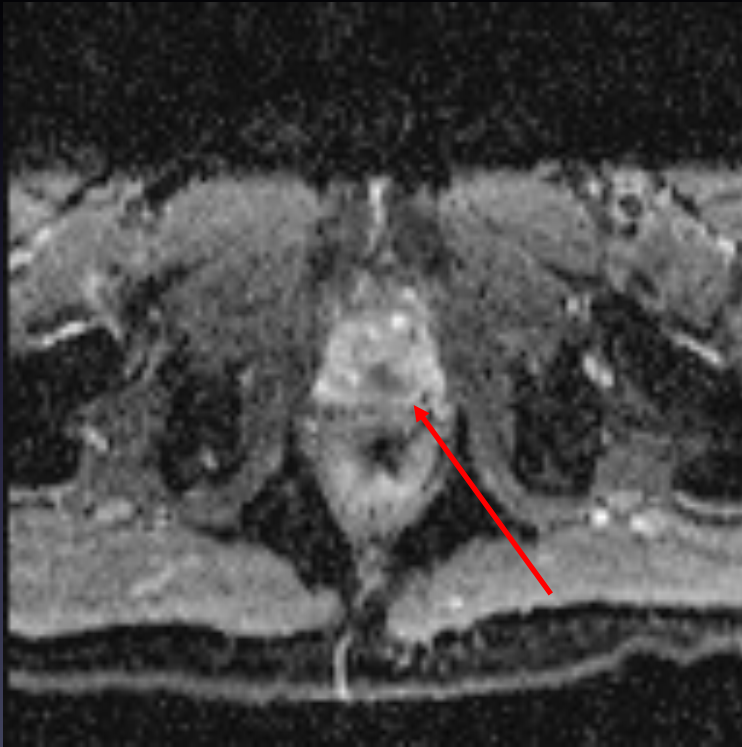


Loc

DWI artifact



ADC windowing



Summary

- Diagnosis of Prostate ca with Mp prostate MRI relies on information from both anatomical and functional imaging
- Normal and pathological conditions have imaging characteristics that overlap with Prostate ca; anatomical structures, benign processes and technical factors
- Awareness by interpreting radiologist is crucial to avoid misinterpretation and over diagnosis of Prostate ca

Thank you!

