PROSTATE MRI

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SANTA FE IMAGING

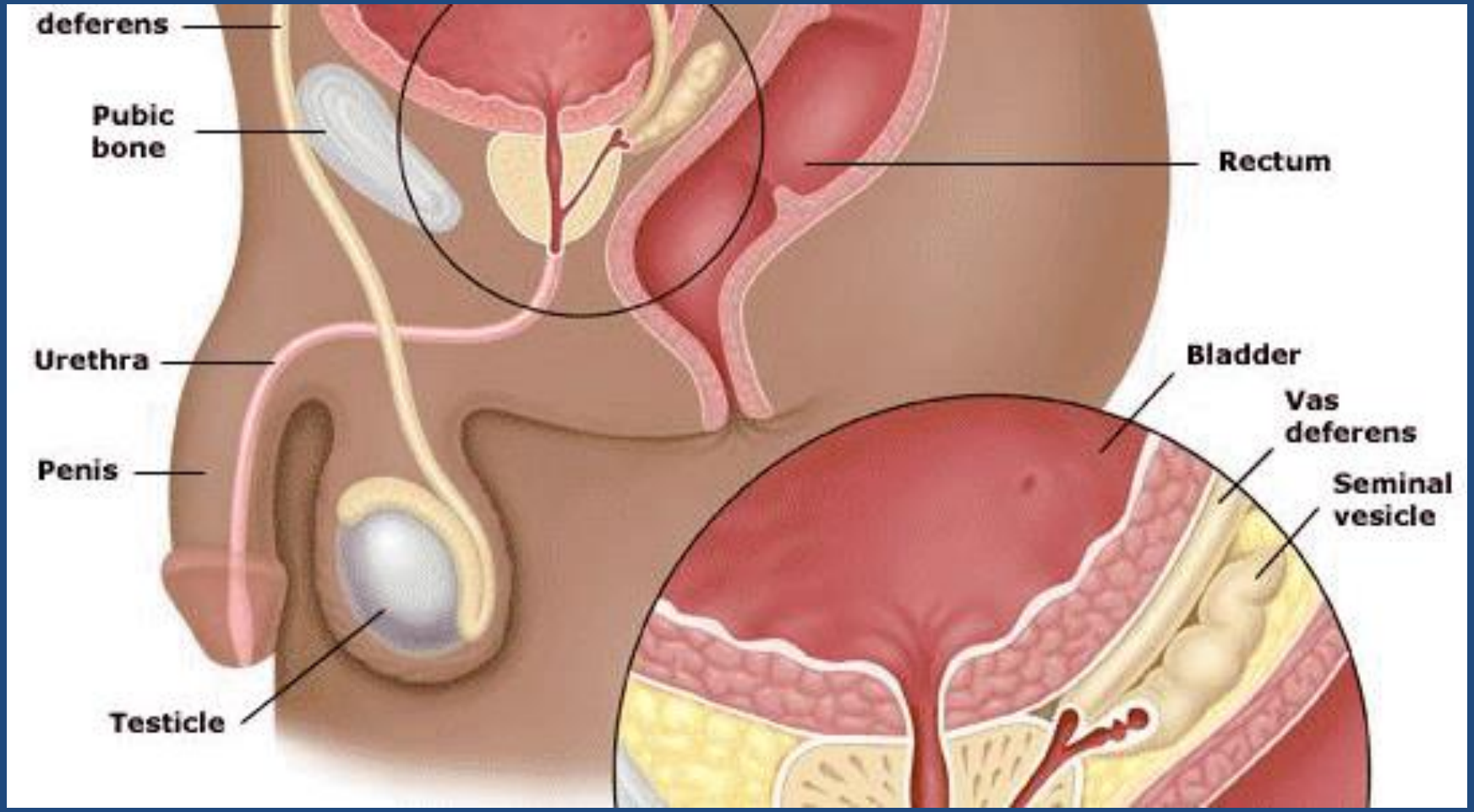
Topics of today's talk

- How does prostate MRI work?
- Definition of multiparametric (mp) MRI
- Anatomy of prostate gland and MRI imaging
- Role of prostate MRI, including example cases
  - Diagnosis
  - Staging
  - Post-treatment
  - Targeting for biopsy

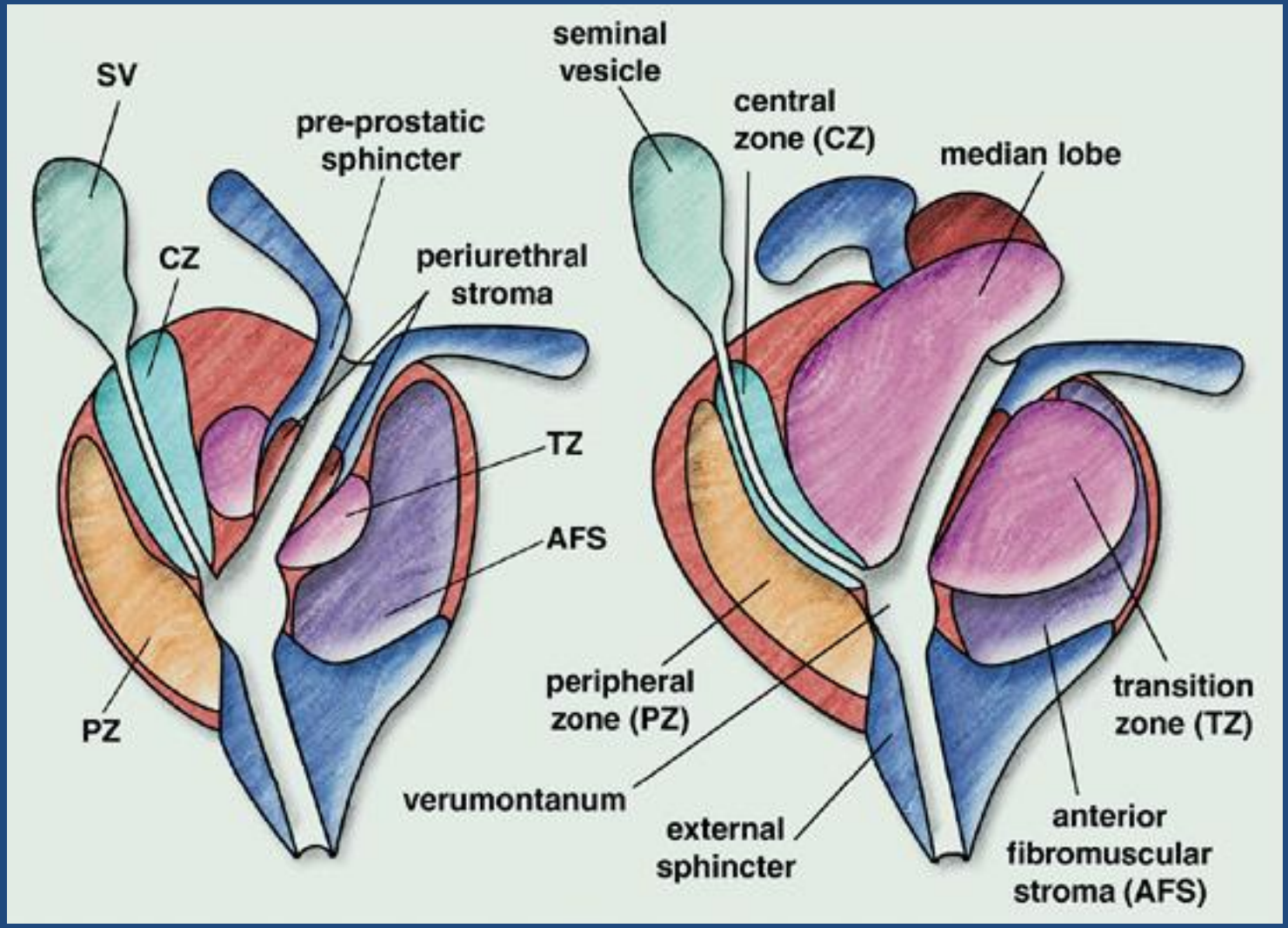
Prostate MRI Technique: Example of patient with body coil

Prostate MRI Technique: Hologic endorectal coil device

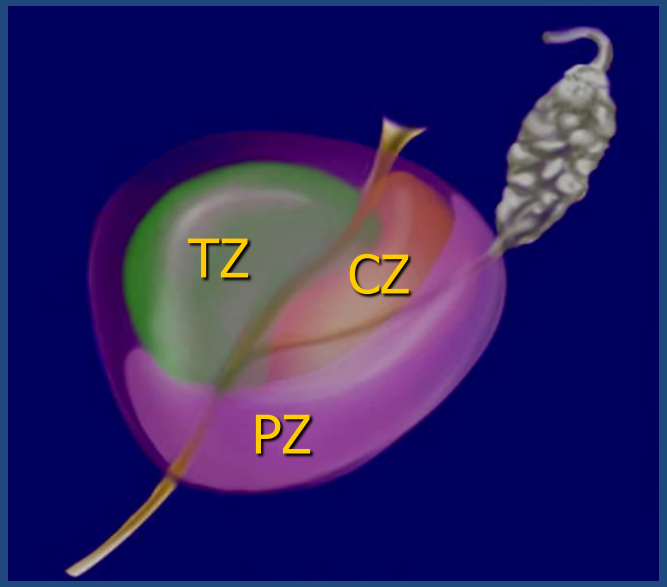
Prostate MRI Anatomy: Why endorectal coil?

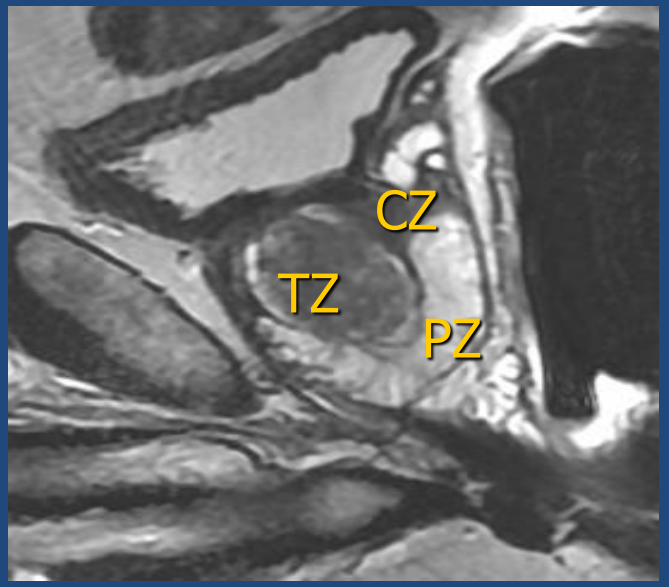


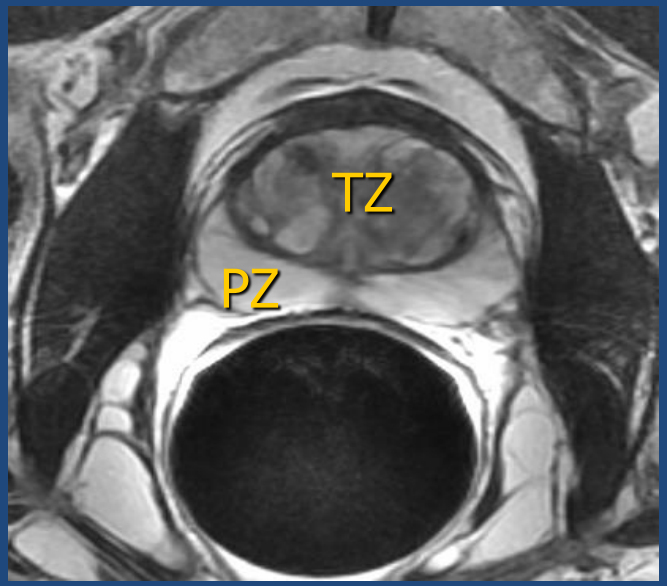
Anatomy

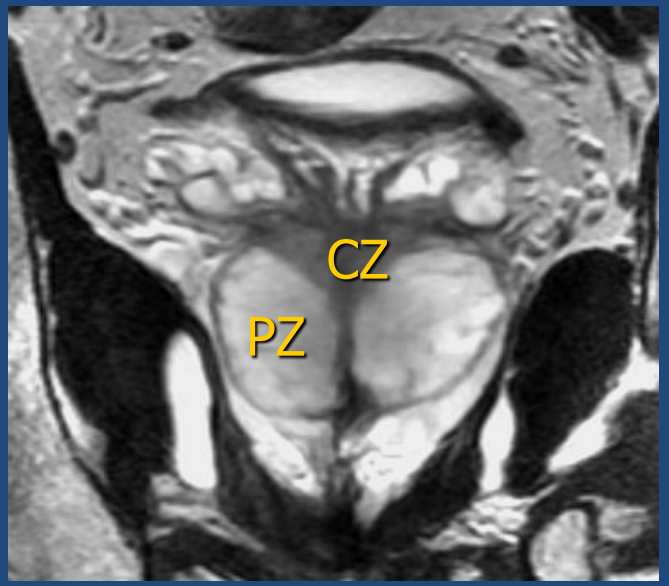

SV
pre-prostatic sphincter
CZ
periurethral stroma
TZ
AFS
PZ
seminal vesicle
central zone (CZ)
median lobe
peripheral zone (PZ)
transition zone (TZ)
verumontanum
external sphincter
anterior fibromuscular stroma (AFS)

Anatomy





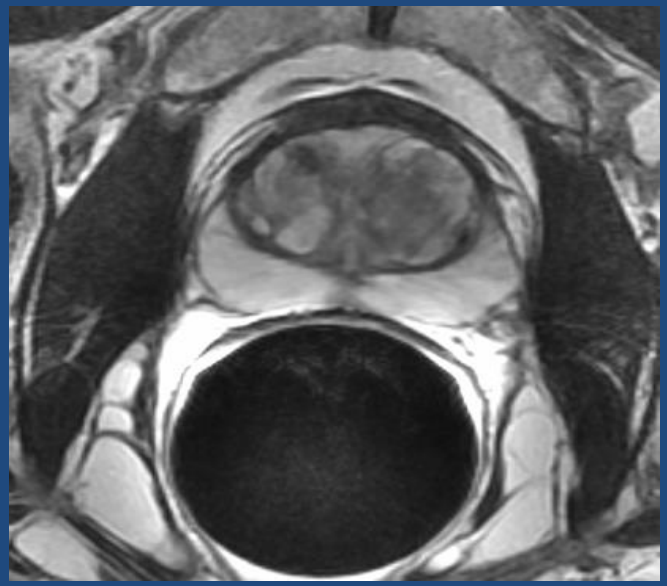




Definition: Multiparametric MRI

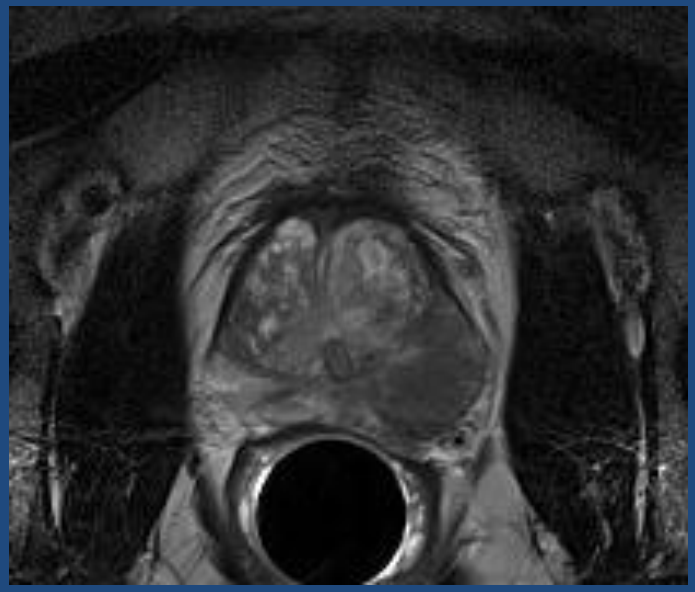
- Standard T2 images are basic sequences for evaluation of peripheral zone
- Diffusion weighted images (DWI)
- Evaluation of dynamic contrast enhancement (DCE) utilizing software for characterizing flow within a lesion

Examples: T2 images



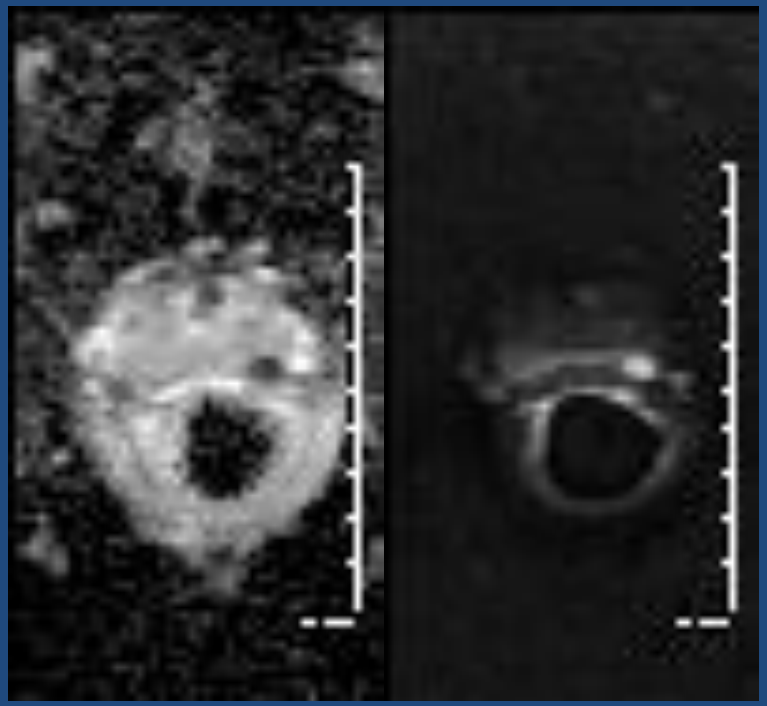
Normal appearance of peripheral zone

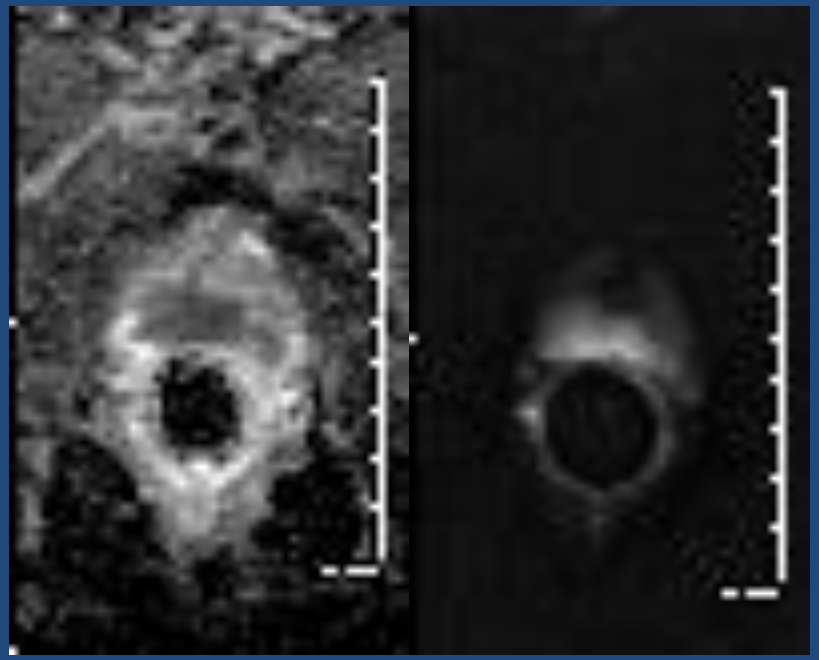
BPH in transition zone



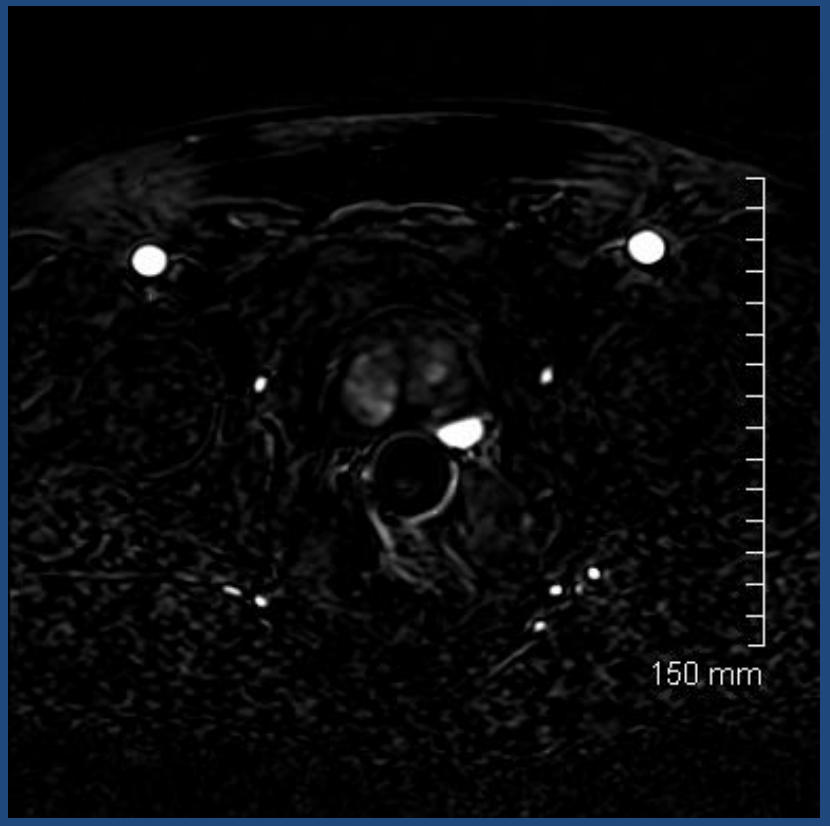
Left peripheral zone replaced by tumor

Examples: DWI images





Examples: DCE images



Typical treatment algorithm

- Begins with :
  - PSA elevation
  - Abnormal digital rectal examination
- Results in:
  - Transrectal ultrasound guided biopsy
- Treatment:
  - Active surveillance
  - Prostatectomy
  - Radiation/hormone therapy

Limitations of current strategy

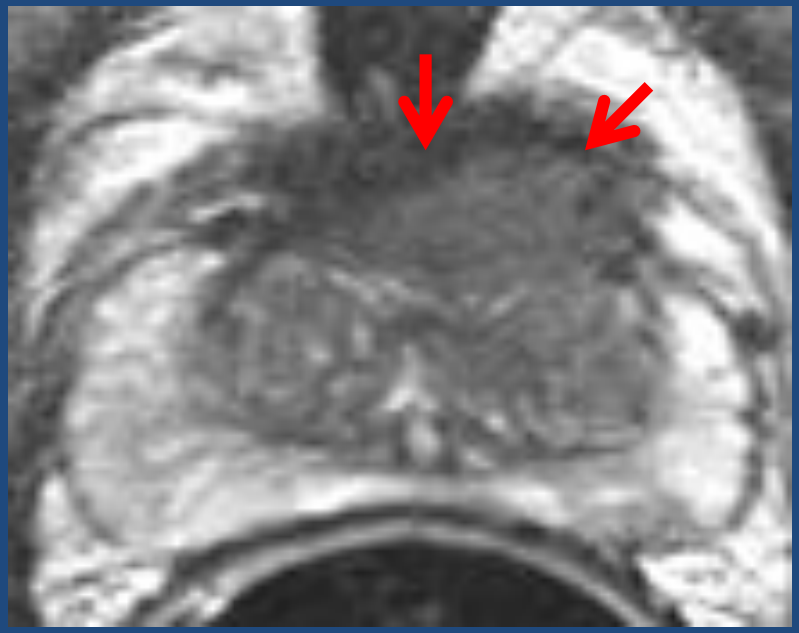
- Low specificity of PSA (~35-40%)
- Transrectal ultrasound biopsy samples 1% of gland and has negative predictive value of 70-80%.
- Prostate cancer is multifocal (>50%)
- Final pathology upgrades Gleason (30%)

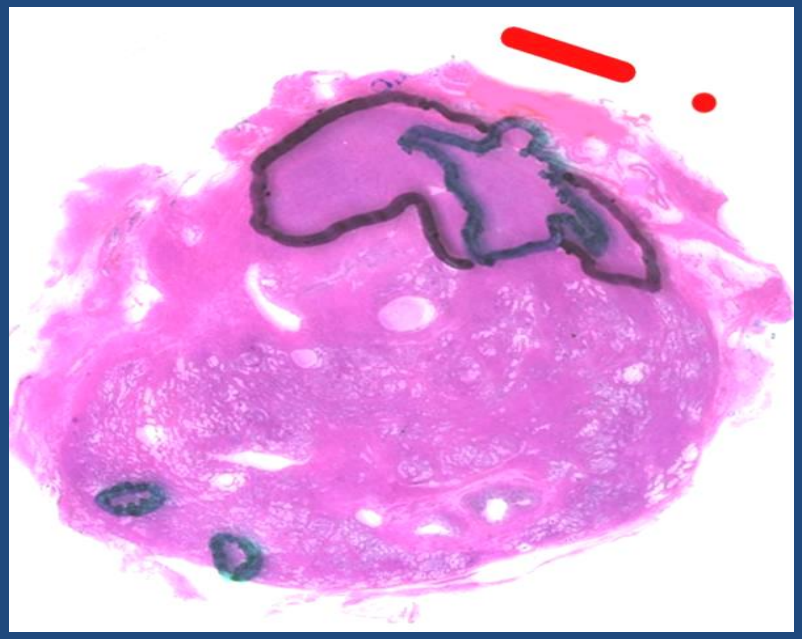
What is role of prostate MRI?

- MRI provides detailed imaging of the entire gland, surrounding soft tissue structures, and bony pelvis, most common place for bone lesions.
- Endorectal ultrasound visualizes the posterior gland and peripheral zone, but not the anterior portion or inferior portion.
- Ultrasound very operator dependent
- Does not visualize lymph nodes
- Does not visualize bones

MRI: Anterior Tumors

- Not palpable
- Often missed on biopsy



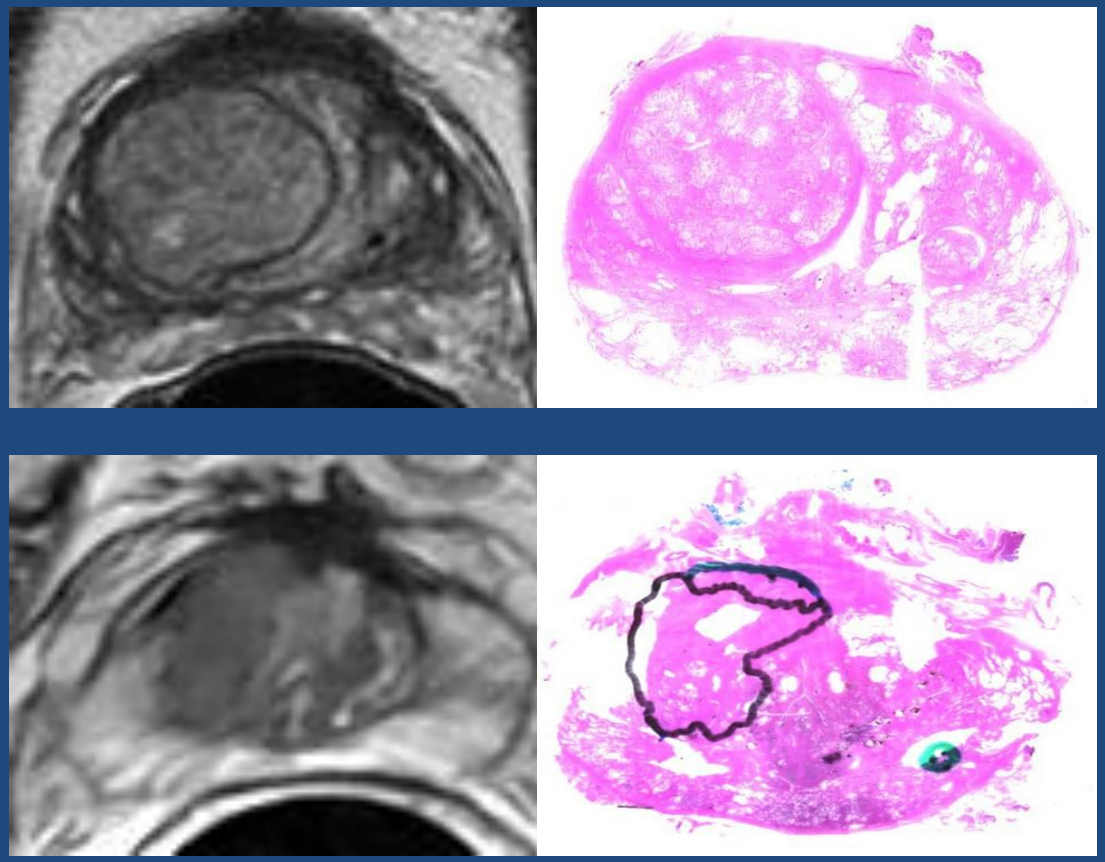


MR Imaging: Transition Zone Cancer

Also missed on biopsy

Hard to identify because of BPH

MRI characteristics can help distinguish



Akin O, et al. Radiology 2006;239:784-792

Role of MRI: Prebiopsy

One study found most utility in identification of higher grade lesions masquerading as low grade lesions

Preoperative Assessment of Prostate Cancer Using Prebiopsy MRI. Ji Hye Min1, Byung Kwan Park1, Jung Jae Park1, Sung Yoon Park1 and Chan Kyo Kim1

Role of MRI: Prebiopsy

- Positive core rates utilizing targeted biopsy were 9.9% (52/527) in the MRI group and 2.4% (11/456) in the non-MRI group. There was a significant difference between the groups (p = 0.001).

Prospective Evaluation of 3-T MRI Performed Before Initial Transrectal Ultrasound–Guided Prostate Biopsy in Patients With High Prostate-Specific Antigen and No Previous Biopsy. Byung Kwan Park1, Jong Wook Park2 3, Seo Yong Park2, Chan Kyo Kim1, Hyun Moo Lee2, Seong Soo Jeon2, Seong Il Seo2, Byong Chang Jeong2 and Han Yong Choi2

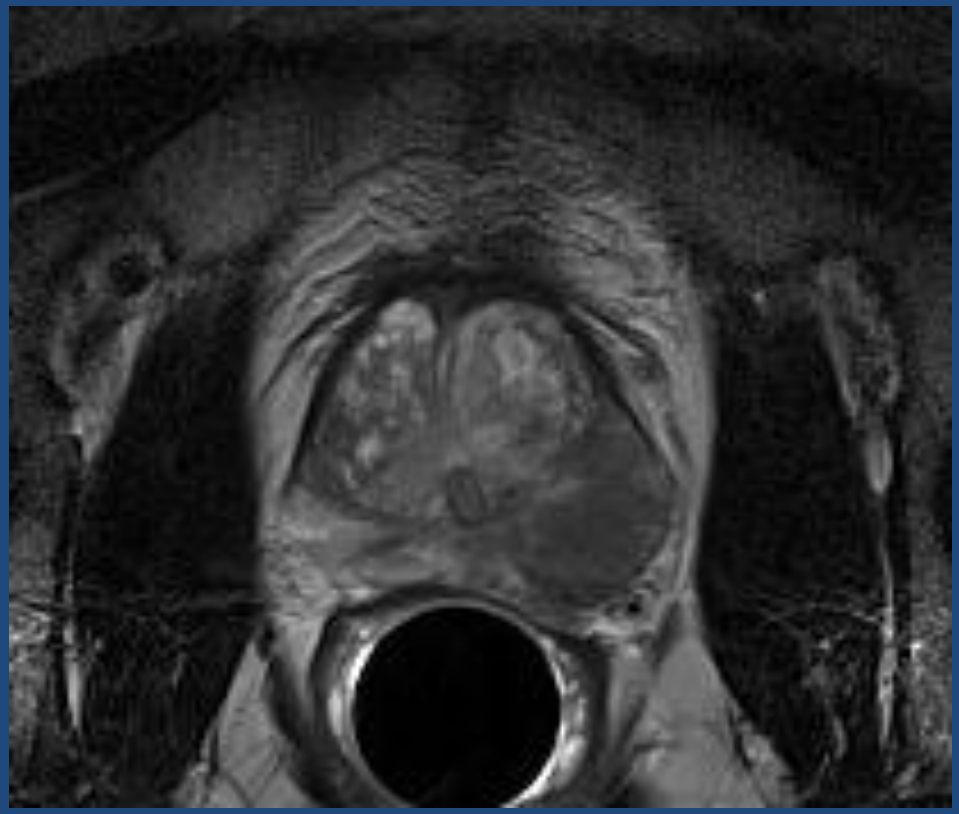
New approaches

- Elevated PSA/Suspicious DRE
- Prostate MRI

  Does patient have a suspicious lesion on imaging?

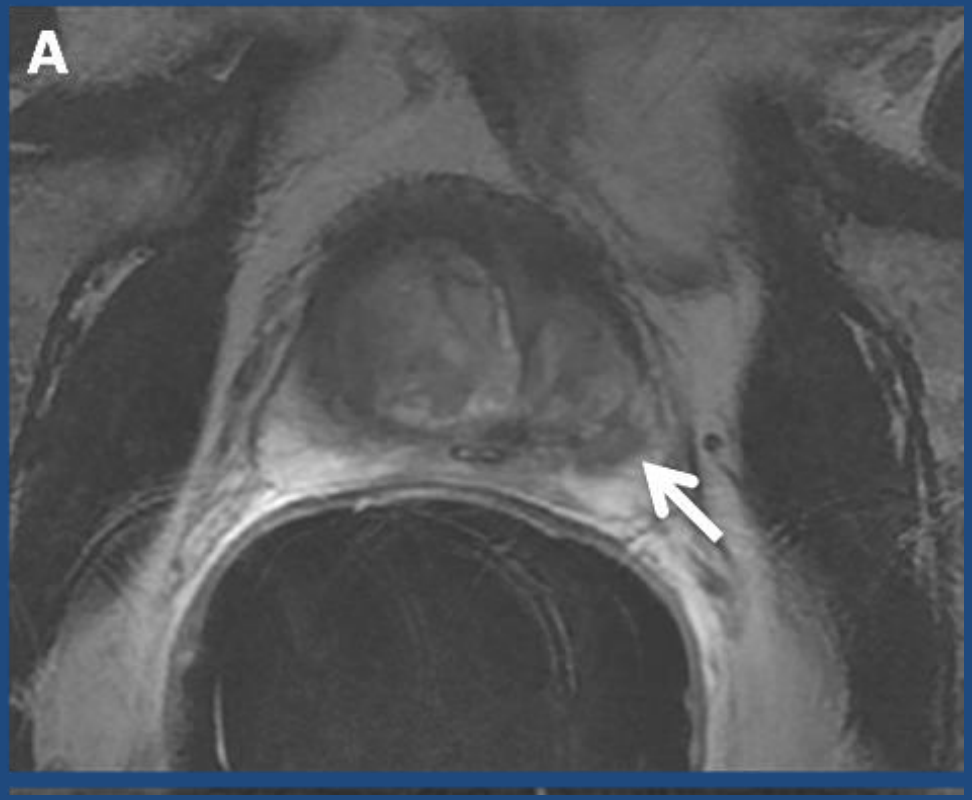
  If not, can we put patient on active surveillance without biopsy?
- Goal: Minimize number of unnecessary biopsies

Example: 54 y.o. on surveillance. First biopsy with Gleason 6 in one core



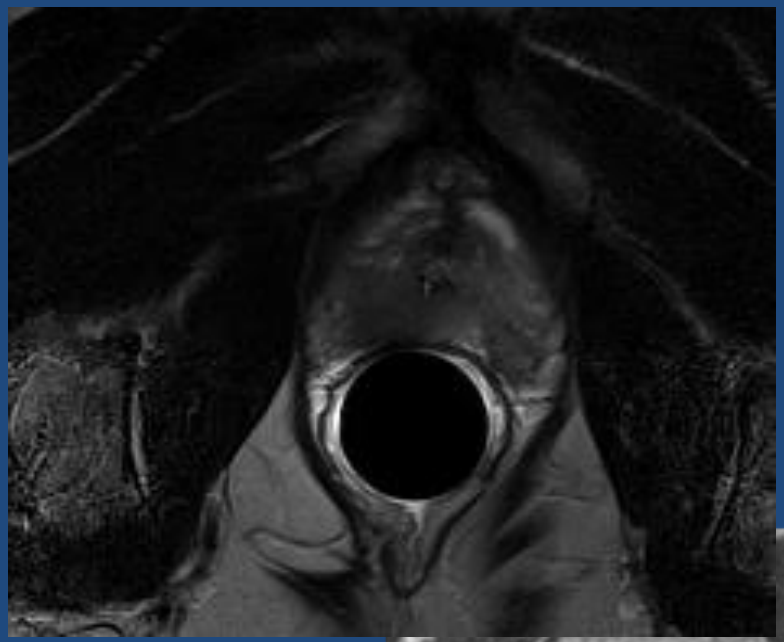
Second biopsy with Gleason 9

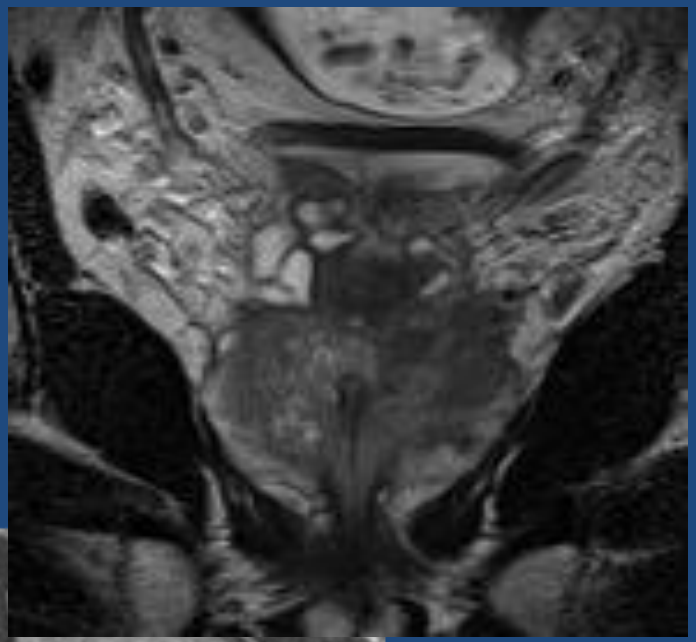
Staging: T2 confined to prostate



Patient may be eligible for active surveillance

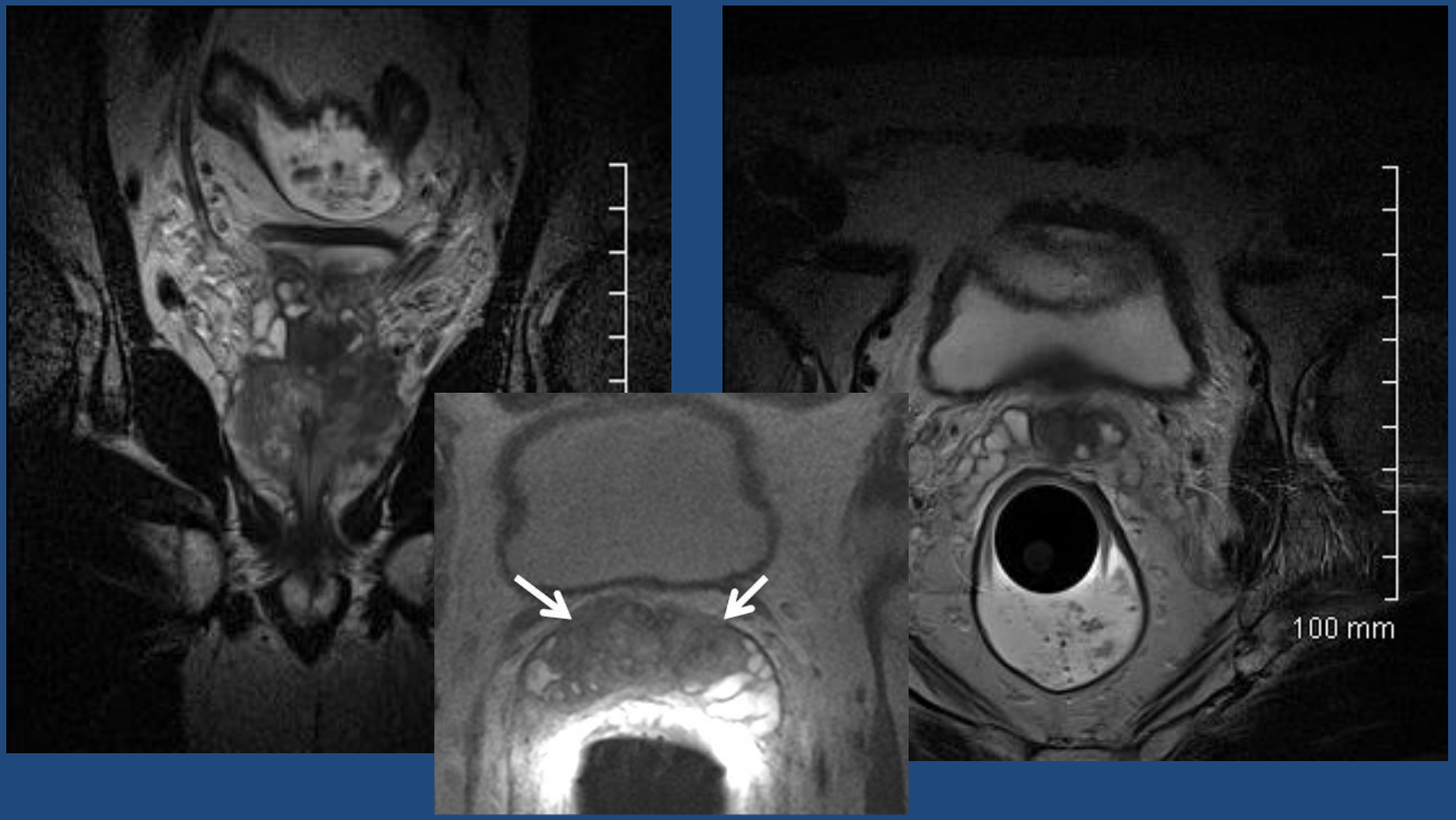
Staging: Extracapsular Extension. Stage T3a





Prostate MRI
Sensitivity and specificity of ECE (0.78 and 0.96)

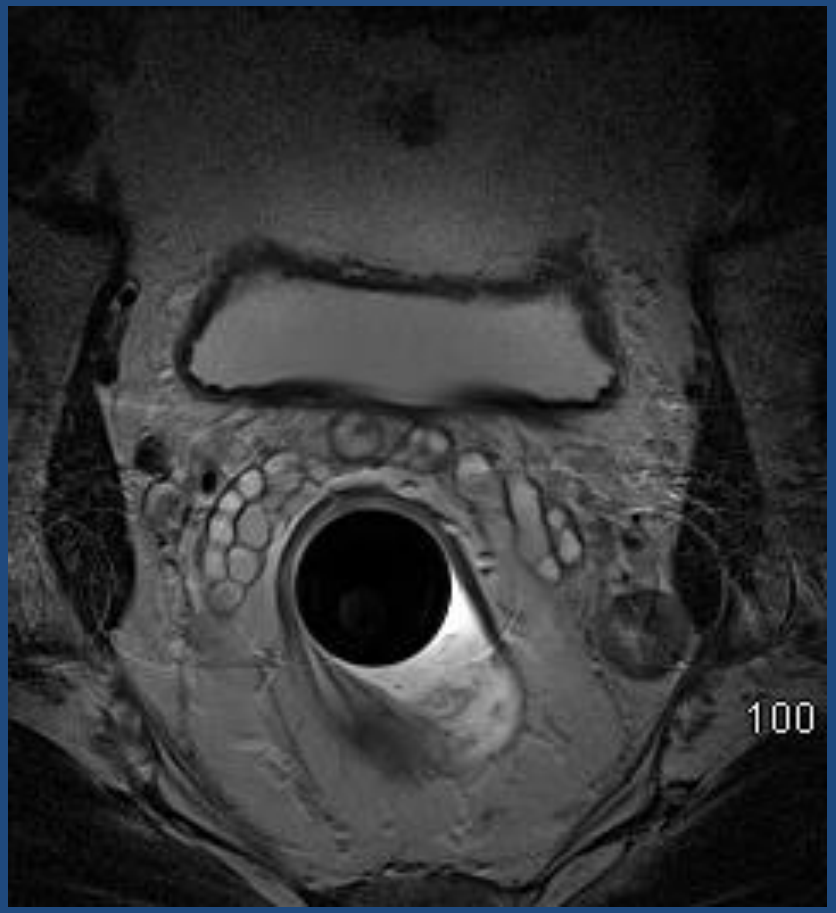
Staging: Seminal Vesicle Invasion T3b



Staging: Nodal Involvement

Features of Malignant Lymph Nodes

- No definite size criteria
- Short axis > 0.5 cm
- Lack of fatty hilum
- Round shape
- Risk of mets in 10 yrs with node negative disease is 30% vs. 80%



Staging: Bone Metastases M1b

Patient with Gleason 3+4 on biopsy and PSA <10.

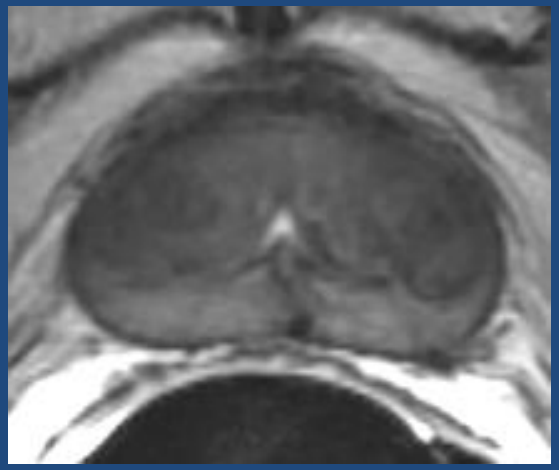
MRI Imaging: After Treatment

- Biochemical relapse defined as PSA level greater than 0.4 ng/ml after prostatectomy.

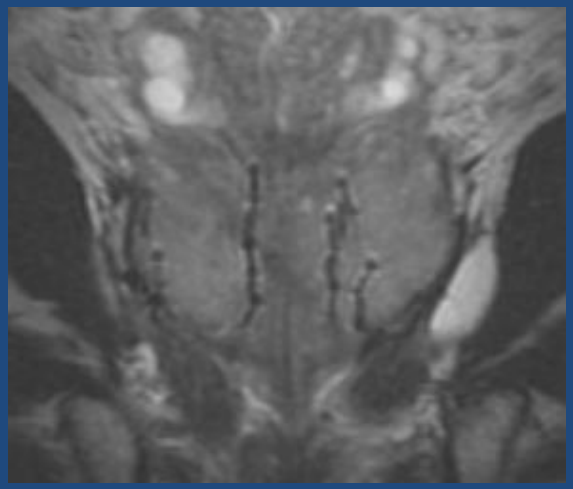
- PSA rise of 2.0 ng/L above nadir or 3 consecutive increases after radiation therapy.

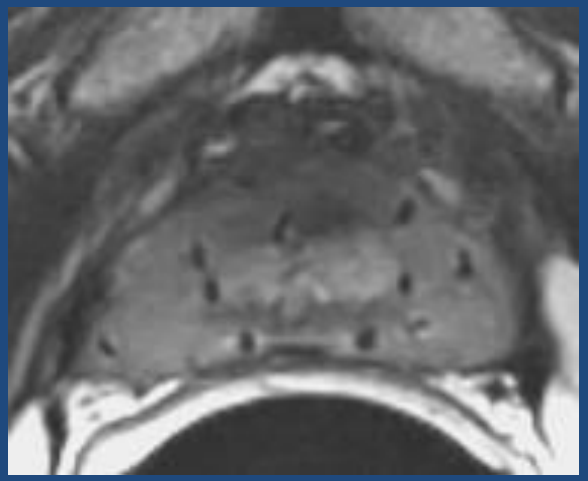
MRI Imaging: Post-Radiation Follow-up

Normal Appearance



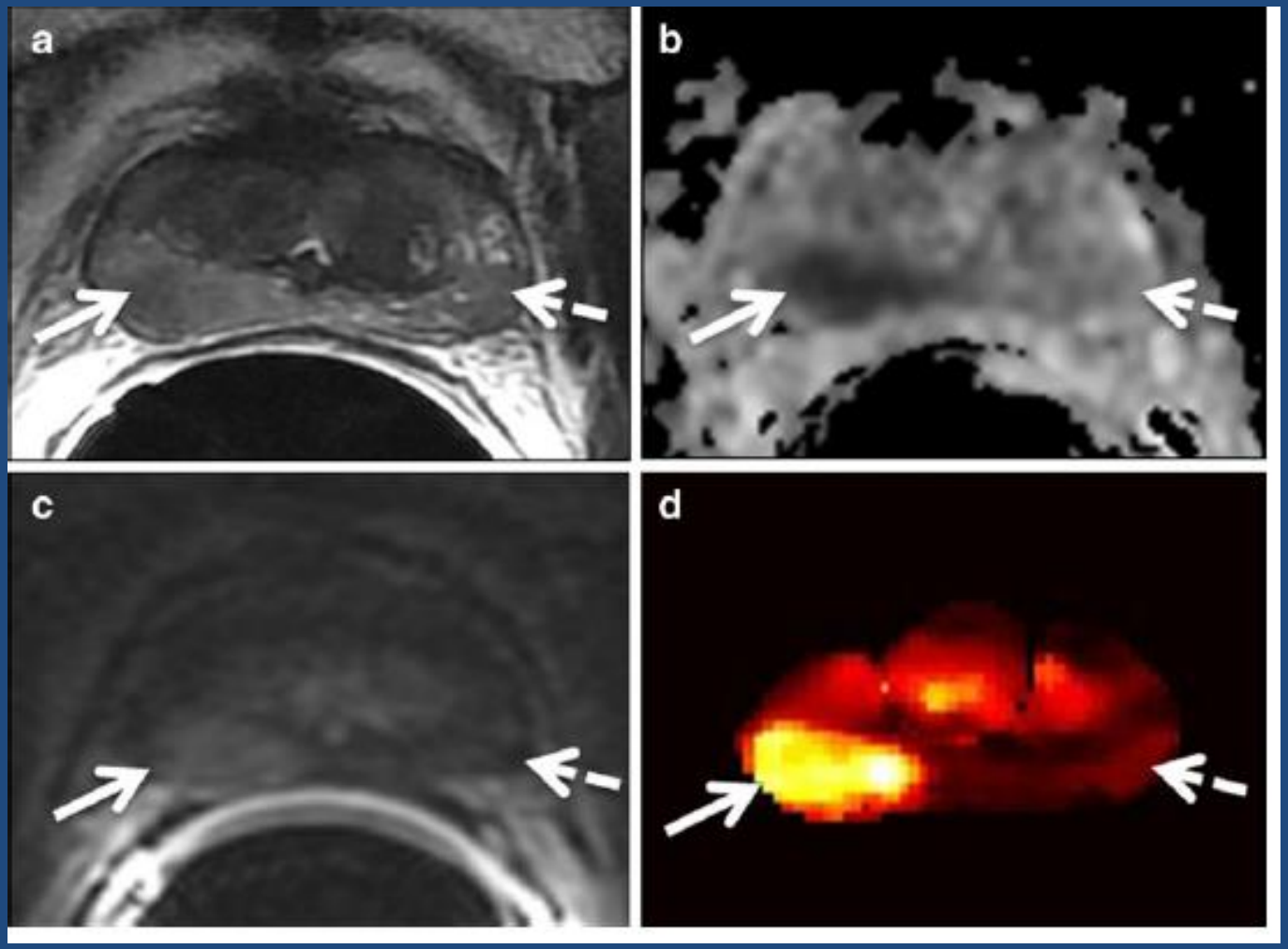
External Beam Radiation





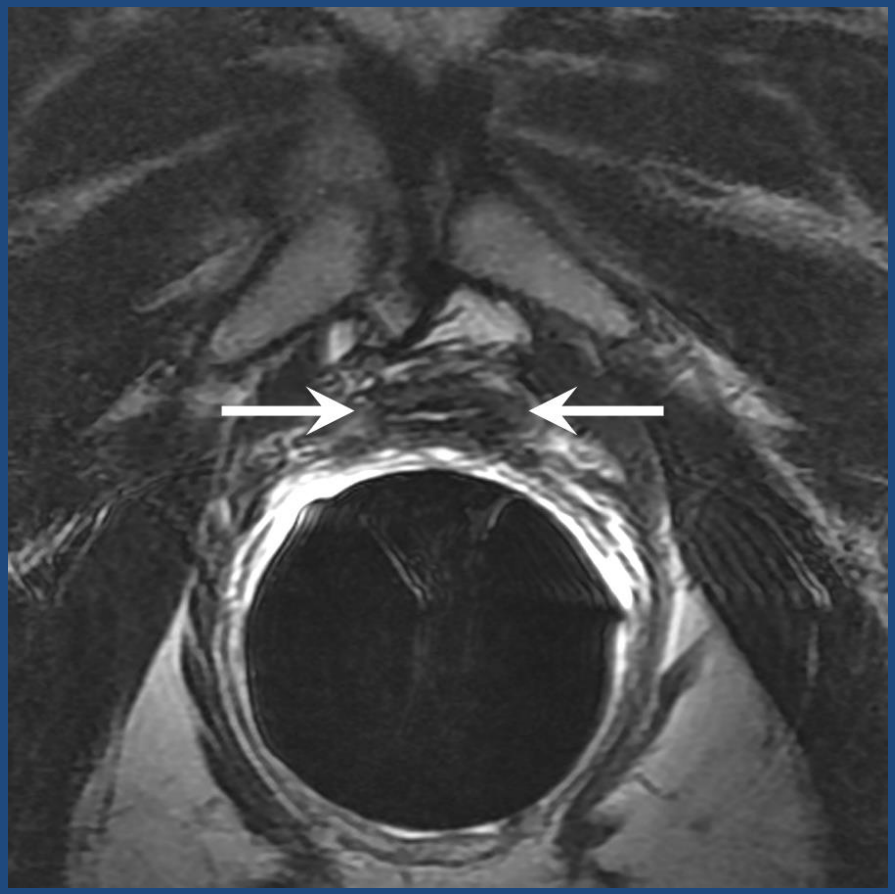
Brachytherapy

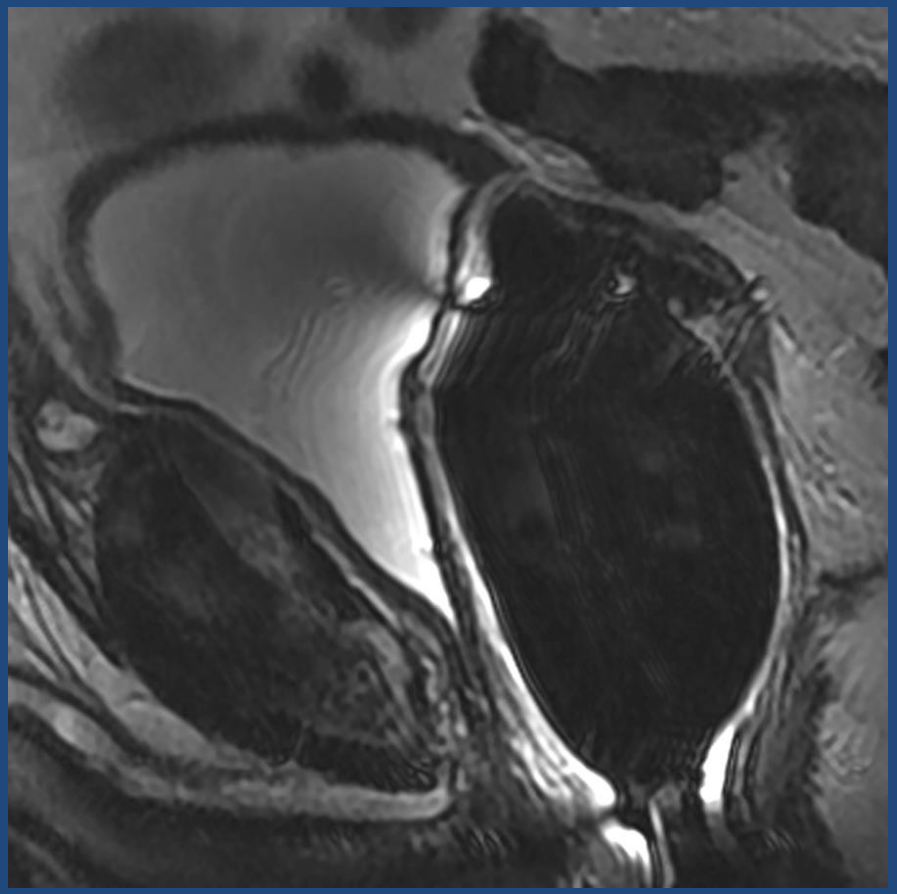
MRI Imaging: Post radiation recurrence



MRI Imaging: Post-Treatment Follow-up

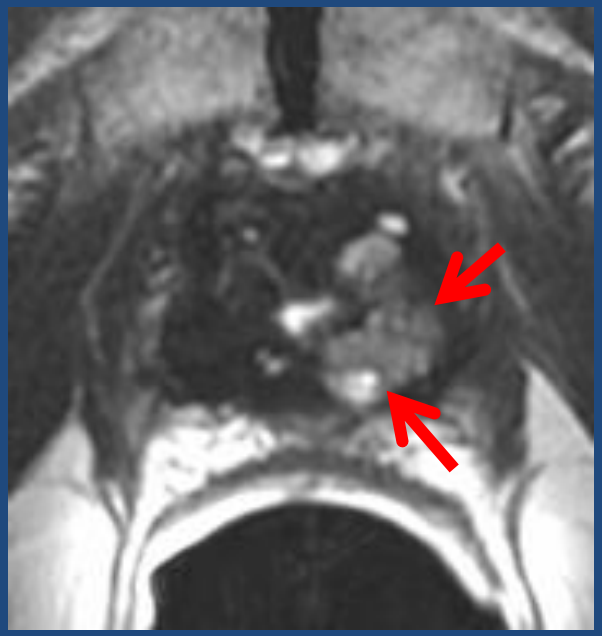
Radical Prostatectomy

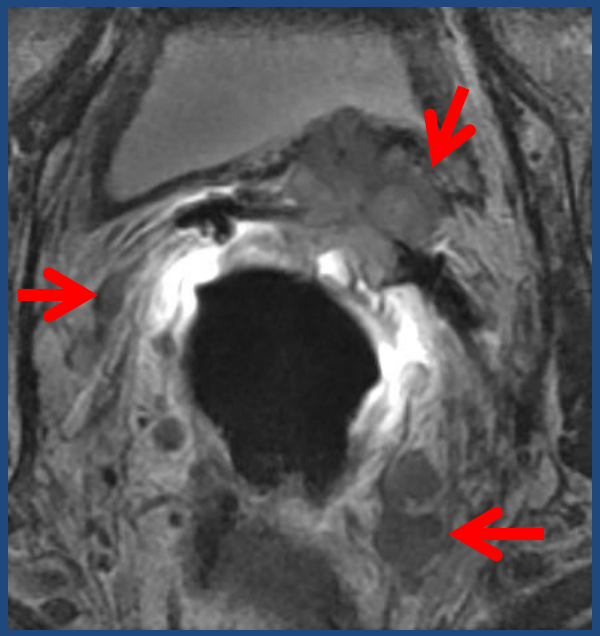




Post-Treatment Follow-up

Recurrence after Surgery





References

- **The Expanding Role of MRI in Prostate Cancer.**Gillian Murphy1, Masoom Haider2, Sangeet Ghai1 and Boraiah Sreeharsha2.
- http://www.ajronline.org/doi/abs/10.2214/AJR.12.10178E
- **ESUR prostate MR guidelines 2012**. European Radiology.April 2012, Volume 22, Issue 4, pp 746-757.

Thank you for coming!