Finding significant Cancer: the PI-RADS current status

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Multiparametric MRI of PCa: definition

- Combination of
  - T2W-MRI
    - Anatomy
  - DW-MRI
    - cellular density
  - DCE-MRI
    - angiogenesis
Standardization of interpretation: PI-RADS

*Prostate Imaging and Reporting Archiving Data System*

- Initiated by the ESUR
  - currently modified by an ACR/ESUR committee

- Aim: to standardize reporting mpMRI

- Expected benefits
  - low inter-observer reporting variability
  - uniform communication with clinicians
  - homogenous clinical research
The PI-RADS score

- Combination of the individual score of
  - T2W/DW-MRI (5 point scale)
  - DCE-MRI (0 or 1)

- Overall score relies on the dominant sequence
  - peripheral zone : DW-MRI
  - transition zone : T2W-MRI

- The presence of a significant PCa is
  - PIRADS 1 = highly unlikely
  - PIRADS 2 = unlikely
  - PIRADS 3 = equivocal
  - PIRADS 4 = likely
  - PIRADS 5 = highly likely
T2W-MRI

- Peripheral Zone
- Transition Zone
PZ-T2W : PIRADS 1

- **Diffuse** hypersignal of the PZ

- normal finding : hyposignal of the CZ
PZ-T2W: PIRADS 2

• Linear or wedge shaped hypointense areas
PZ-T2W : PIRADS 2

- **Diffuse** hypointense areas
  - Indistinct margins
• **Focal** nodular/mass-like hyposignal
  - homogenous, circumscribed
  - confined to the prostate and < 1,5cm
PZ-T2W : PIRADS 5

- Same as 4 **but**
  - extra-prostatic spread or
  - > 1.5 cm
PZ-T2W : PIRADS 3

- **Focal**, but not a 2 not a 4
  - non circumscribed
  - rounded or geographic
T2W-MRI

- Peripheral Zone
- Transition Zone
TZ-T2W : PIRADS 1 and 2

- PIRADS 1
  - heterogenous pattern

- PIRADS 2
  - encapsulated nodule
  - hypointense or heterogenous

- ADC-DW-DCE
  - not considered
TZ-T2W : PIRADS 4

- **Focal** hyposignal, homogenous, indistinct
  - lenticular shape
  - anteriorly located
  - confined, < 1.5 cm
TZ-T2W : PIRADS 5

• Same as 4 but
  – > 1.5 cm
  – invasive (AFMS or PZ)
TZ-T2W : PIRADS 3

- **Focal**, same as 4 but heterogenous
  - Non lenticular shape
  - No size limitation
DW-MRI
DW-PZ/TZ : PIRADS 1

- **No focal abnormality** on ADC map and high b-DW-MRI
DW-PZ : PIRADS 2

- **Linear**: hypoS on ADC map, isoS on DWI

T2, ADC, $b \geq 1400$
DW-PZ : PIRADS 2

- **Diffuse**: hypoS on ADC, iso/hyperS on DWI
• **Within a BHP** hypoS on ADC, hyperS on DWI

**DW-TZ/PZ : PIRADS 2**
DW-PZ : PIRADS 4

- **Focal** : hypoS on ADC / hyperS on DW-MRI
  - T2 effect : not observed at b-values ≥ 1400
  - No BHP
  - <1.5cm on axial
DW-TZ  PIRADS 4

• **Focal:** hypoS on ADC/hyperS on DWI
  - brighter than the brightest area
  - < 1.5 cm on axial
  - No BHP
• **Focal:** hypoS on ADC/hyperS on DWI
  - >1.5cm on axial
DW-TZ : PIRADS 5

- **Focal** : hypoS on ADC / hyperS on DW-MRI
  - >1.5cm on axial
DW-TZ : PIRADS 5

- **Focal:** hypoS on ADC/hyperS on DWI
  - >1.5 cm
DW-TZ/PZ : PIRADS 3

- **Focal**
  - IsoS on DW: as bright as the rest of the prostate
  - HypoS or isoS on ADC map

PIRADS 3 on the right side of the TZ
DW : PIRADS 3

- bilateral significant tumor (GS 7, 15% grade 4)
DCE-MRI
DCE : PI-RADS

- Currently modified
  - types 2-3 curves do not ≠ PCa
    - from prostatitis (PZ)
    - from stromal nodules (TZ)
  - DCE may be dichotomized 0/1
    - 1 = focal early enhancement
      - on a corresponding hypointense focus (except BPH)
      - wash out not considered
PZ-DCE : PI-RADS +1

- focal early enhancement on a hypointense focus
TZ-DCE : PI-RADS +1

- focal early enhancement on a hypointense focus
Overall PI-RADS Assessment
Overall PI-RADS Assessment

- **Peripheral Zone (PZ) > DWI**

<table>
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<th>DWI</th>
<th>T2W</th>
<th>DCE</th>
<th>PIRADS Category</th>
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<td>5</td>
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Overall PI-RADS Assessment

- Transition Zone (TZ) > T2

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Conclusion

- Objectives of the PIRADS
  - detection of most significant tumors
  - decrease the number of useless biopsies
- Updates in the last version
  - dominant sequence
    - DW for the PZ and T2W for the TZ
    - DCE : optional in most cases
- Advanced DW-MRI will improve its accuracy
Case#1 : Overall PI-RADS Score?

- 65 y/o; PSA level 7 ng/ml
- MRI before biopsy

1. PIRADS 1
2. PIRADS 2
3. PIRADS 3
4. PIRADS 4
5. PIRADS 5
Case#1

- 65 y/o; PSA level 7 ng/ml
- MRI before biopsy
- PIRADS scores
  - T2W: 2
  - DW : 4
  - DCE : 0
Case#1

- 65 y/o; PSA level 7 ng/ml
- MRI before biopsy
- PIRADS scores
  - T2W: 2
  - DW : 4
  - DCE : 0
- PZ lesion
  - dominant sequence= DW
  - PIRADS score 2-4-0 = 4
- Gleason 7\(_{4+3}\) Ca
Case#2 : Overall PI-RADS Score ?

- 67 y/o; PSA: 6ng/ml
- MRI before biopsy

1. PIRADS 1
2. PIRADS 2
3. PIRADS 3
4. PIRADS 4
5. PIRADS 5
Case#2

- 67 y/o; PSA: 6ng/ml
- MRI before biopsy

- PIRADS scores
  - T2W : 3
  - DW : 4
  - DCE : 0
Case#2

- 67 y/o; PSA: 6ng/ml
- MRI before biopsy
- PIRADS scores
  - T2W: 3
  - DW : 4
  - DCE: 0
- PZ lesion
  - dominant sequence = DW
  - PIRADS score 3-4-0 = 4
- Gleason 7\textsubscript{4+3} Ca
Case#3: Overall PI-RADS Score?

- 64 y/o; PSA: 9ng/ml
- MRI prior 4th set of bxs

1. PIRADS 1
2. PIRADS 2
3. PIRADS 3
4. PIRADS 4
5. PIRADS 5
Case#3

- 64 y/o; PSA: 9ng/ml
- MRI prior 4th set of bxs
- PIRADS scores
  - T2W: 5
  - DW : 5 (>15mm)
  - DCE: 0
Case#3

- 64 y/o; PSA: 9ng/ml
- MRI prior 4th set of bxs
- PIRADS scores
  - T2W: 5
  - DW : 5 (>15mm)
  - DCE: 0
- TZ lesion
  - dominant sequence=T2
  - PIRADS score 5-5-0 = 5
- Gleason $7_{3+4}$ Ca
Case#4 : Overall PI-RADS Score?

- 64 y/o; PSA (5→7→9ng/ml)
- MRI prior biopsies

1. PIRADS 1
2. PIRADS 2
3. PIRADS 3
4. PIRADS 4
5. PIRADS 5
Case #4: Overall PI-RADS Score?

- 64 y/o; PSA (5→7→9ng/ml)
- MRI prior biopsies
- PIRADS scores
  - T2W: 2
  - DW: 2
  - DCE: +1
Case#4 : Overall PI-RADS Score ?

- 64 y/o; ↑ PSA (5→7→9ng/ml)
- MRI prior biopsies
- PIRADS scores
  - T2W: 2
  - DW : 2
  - DCE: +1
- TZ lesion
  - dominant sequence =T2
  - PIRADS score 2-2-1 = 2
- TB+SB : benign