IRM de la prostate: protocoles adaptés à l’équipement

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Objectives of prostate MpMRI

- Detection of significant tumors
  - men with a reasonably long life expectancy
  - ideally with a curable tumor
- Accurate local staging
  - selection of an appropriate treatment
- Is it possible in a single examination?
Minimum requirements

• Preparation
  – laxative and aspiration of rectal air
    • female bladder catheter, patient on the MRI table
• T2W-MRI:
  – 2D three planes multislice acquisition (4 NEX per plane)
    • acquisition time : 12-16 mn, ST: 3-4mm
  – 3D space acquisition (1mm ST)
    • increases tumor to adjacent tissue signal (*Rosenkrantz, AJR, 2010*)
    • covers the whole pelvis (224 partitions), MPR
    • acquisition time : 8 mn
# T2W-MRI protocol

<table>
<thead>
<tr>
<th>Field strength</th>
<th>1.5T</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>no e-coil</td>
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<tr>
<td>Slice thickness:</td>
<td></td>
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<tr>
<td>2D</td>
<td>3-4</td>
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<tr>
<td>3D</td>
<td>0.8</td>
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<td>In plane resolution</td>
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<td>2D</td>
<td>0.7x0.7</td>
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<td>#slices</td>
<td></td>
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<tr>
<td>2D</td>
<td>20</td>
</tr>
<tr>
<td>3D</td>
<td>224</td>
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<td>Acquisition time/plane</td>
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<td>2D</td>
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Minimum requirements

• Limitations of 1.5T magnets
  – limited performance of DW-MRI
    • SNR when b-value
    • especially if b-values ≥ 1500 are used*

• The best visibility of PCa
  – achieved at a b-value ≥1500**

*Neil, 2008, JMRI
**Metens et al, 2013, Eur Radiol
Minimum requirements

- Recent MRI platforms provide an $\uparrow$ SNR
  - 20-40 channels PPA coil
  - gradient amplifiers
- Computed high b-values at 3T*
  - creation of cDWI images
    - from a b0-b800 sequence
- SNR (PCa vs benign) at b values $\geq$1400
  - similar in computed vs acquired images

*Maas et al, 2013, Invest Radiol
Minimum requirements

Dr A. Scherrer, Hôpital Foch
Computed vs acquired b-values

(Siemens hypergradient Avanto 1.5T, 32 channels cardiac coil)

Gleason score 7 (4+3) PZ anterior Ca
Computed vs acquired b-values

(Siemens hypergradient Avanto 1.5T, 32 channels cardiac coil)

TRUS-MRI targeted biopsies: Gleason score 7 (4+3) TZ Ca
Detection at 1.5T without rectal coil

(Siemens hypergradient Avanto 1.5T, 32 channels cardiac coil)

• DW-MRI
  – single shot EPI, 4-6 NEX, TE<100ms
  – acquisition time : 6-8 mn
  – Slice Thickness of T2W-MRI
  – b-values
    • 50- 500-1000 (ADC value)
    • computed b1600 value
Detection at 1.5T without rectal coil

(*Siemens hypergradient Avanto 1.5T, 32 channels cardiac coil*)

- **DCE**
  - technique: GE, temporal resolution \( \sim 10s \)
  - acquisition time
    - 2mn if only wash-in is considered
  - slice thickness of T2W-MRI
  - may become optional
    (*Iwazawa et al, 2011 Dg and Interv Radiol, 2011*)

- accuracy of T2+DW+DCE may not be > T2+DW
Local staging of PCa:
optimal requirements of mp-MRI at 1.5T

• To define with a high specificity
  – established MRI T3a or T3b stage (TT option)
  – equivocal MRI stage
    • corresponding pathological stage
      – pT2 or limited pT3 stage (≈ 50% each)
    • brachytherapy or focal TT may be proposed
  – unequivocal MRI T2 stage
    • to include patients in an AS or FT protocol
## T2W-MRI protocol

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High resolution MRI

resuable ecoil  

pelvic coil 3T
Staging at 1.5T without rectal coil

- Historically: performs less well than the rectal coil
  - Accuracy: 68% vs 77%*
- MRI platform: Signa

*Hricak et al, Radiology, 1994

\[ p = 0.0002 \]
Staging at 1.5T without rectal coil

- Historically: performs less well than the rectal coil
  - Accuracy: 68% vs 77%*
    - MRI platform: Signa
      *Hricak et al, Radiology, 1994

- AUC: 0.57-0.67 vs 0.70-0.76*
  - ECE and SVI
  - MRI platform: Siemens Vision
    *Futterer et al, Radiology, 2007
PPA coil: true positive MRI-T2 stage
(Siemens Avanto platform, 32 channels cardiac coil)

• Gleason score 6 tumor
  – two positive targeted biopsies, Ca length on one core: 4mm
PPA coil: true positive MRI-T2 stage
(Siemens Avanto platform, 32 channels cardiac coil)

pT2 stage (no capsular infiltration)
PPA coil: true positive MRI-T3 stage
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PPA coil: true positive MRI-T3 stage

established pT3a stage, GS 4+4, negative margins
PPA coil: what is the MRI stage?

1. T2
2. Equivoque
3. T3 limité
4. T3 étendu
PPA coil: understaging of an equivocal stage

- established pT3a stage
PPA coil: understaging of an equivocal stage

- established pT3a stage (3mm radial ECE)
PPA+ecoil: true positive MRI T2 stage

MRI T2-stage/pT2 stage
PPA+ecoil: true positive MRI T3 stage

MRI T3-stage/extensive pT3a stage (RAT..)
PPA+ecoil: MRI stage?

1. T2
2. Equivoque
3. T3 limité
4. T3 étendu
PPA+ecoil: equivocal MRI stage

- limited pT3 stage (0.8 mm radial ECE)
# PPA vs ER coil and ECE detection

*(Siemens hypergradient Avanto 1.5T, 32 channels cardiac coil)*

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¹ Cornud et al, unpublished data
Valeur ajoutée de la précision dg de l’antenne ER pour le dg d’ECE?

1. +10%
2. +30%
3. +50%
4. 0%
**PPA vs PPA+e-coil and ECE detection**

* (Siemens hypergradient Avanto 1.5T, 32 channels cardiac coil)

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<td>37</td>
<td>77</td>
<td>71 (p&lt;0.01)</td>
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<tr>
<td>pre-bx MRI PPA+e-coil¹ (n=144)</td>
<td>47</td>
<td>92</td>
<td>81</td>
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¹ Cornud et al, unpublished data
Conclusion

- 1.5T MRI accurately detects PCa
- A pre TT repeat MRI with the ecoil
  - may be recommended if PPA coil shows
    - an established T3 stage to avoid FP cases
    - an equivocal stage to detect established T3 stage
  - is probably not necessary for unequivocal T2 stage