MR-TRUS Fusion Biopsy

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Prostate cancer mortality according to risk groups

Prevention of overdiagnosis and overtreatment

Rider J, Eur Urol 2013
The problem of standard TRUS biopsies

- recommendation: 10-12x TRUS guided (detection rates 24-44%)
- up to 90% prevalence of false negative bilaterality in RPx specimens
- upstaging 40-60%
- upgrading (Gleason) 35-65%
- high rate of misses in ant. tumors
- no registration of biopsy sites

Falzarano, J Urol, 2010
Heidenreich, Eur Urol, 2011
Roehrborn, Eur Urol 2011
de la Rosette, J Urol 2009
Barzell et al.: J Urol 2012
Hambrock, J Urol 2010
The problem of standard TRUS biopsies

• high rate of underdiagnosis of aggressive disease

• high rate of overdiagnosis of insignificant disease

• problem of «gold standard» reference

Lecornet, J Urol 2012
Key definitions START consortium

Table 2 – Key definitions related to magnetic resonance imaging–targeted biopsy of the prostate

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>MRI-targeted biopsy Guidance during MRI-targeted biopsy Image registration Visual registration Software registration</td>
<td>Any biopsy technique where an MRI scan is used to determine the location of a suspicious target prior to biopsy. Method of assistance used by the operator in directing the biopsy needle at a target originally identified on MRI. Guidance is usually carried out using ultrasound or MRI. Image registration is required to match the image of the target defined on MRI with the real-time image of the prostate during the biopsy procedure. This registration can be done with or without the use of software. The target identified on MRI is registered to the real-time biopsy ultrasound image by the biopsy operator without the use of software. (Fig. 2). The target identified on MRI is registered to a real-time biopsy ultrasound image by use of computer-based software that overlays the target onto the ultrasound image. This has also been referred to as MRI/TRUS fusion in the literature.</td>
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<tr>
<td>Direct in-bore biopsy Robot-assisted biopsy</td>
<td>Biopsy technique carried out within the MRI scanner where the target identified on MRI during a diagnostic scan is biopsied using guidance from serial MRI scans during the biopsy procedure, performed in an open magnet. (Fig. 4). Any biopsy where a robotic device is used to move the biopsy needle.</td>
</tr>
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</table>

MRI = magnetic resonance imaging; TRUS = transrectal ultrasound.

Moore, START Cons., Eur Urol 2013
The multiparametric MRI

• 1.5/3T mpMRI w/wh endorectal coil

• Consists of:
  – high resolution T2 sequences
  – multiparametric methods
    • diffusion weighted MRI (DWI)
    • dynamic contrast enhanced MRI (DCE)
    • hydrogen-spectroscopy (H-MRS)
PI-RADS classification

• prostate imaging-reporting and data system
  (according to BI-RADS breast cancer diagnostics)
• score 1-5 for every modality

# PI-RADS Reporting

## Standardized MRI Reporting Scheme

**Name:** [Blank line]

**Date:** [Blank line]

**PSA:** [Blank line]

**Previous Biopsies:** [Blank line]

**Previous MRI scans:** [Blank line]

### Individual Scoring

<table>
<thead>
<tr>
<th>Region</th>
<th>T2</th>
<th>DWI</th>
<th>DCE</th>
<th>MRS</th>
<th>Sum</th>
<th>PI-RADS</th>
</tr>
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**Total score PI-RADS:**

- PI-RADS: 1 – benign; 2 – most probably benign;
- 3 – intermediate; 4 – probably malignant;
- 5 – highly suspicious of malignancy

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Standardized MRI prostate reporting scheme, PI-RADS.

*Parts of Fig. 7 are based on Dickinson et al. 2011 [4].*
The multiparametric MRI

- sensitivity 78%, specificity 79%
- detection of clinically significant disease 44-87%
- negative predictive value 63-98%
- excellent correlation between MRI and tumor volume (RPx)

Fütterer, Review, Eur Urol 2015
Hamoen, Meta Analysis, Eur Urol 2014
Turkbey, Pinto, J Urol 2012
MR-TRUS fusion biopsy

- MR-TRUS Fusion
- (In-bore MRI)

- transrectal or perineal approach

- most popular systems:
  Artemis, UroNav, UroStation, Biopsee

- site of biopsy is recorded
Transrectal vs. perineal biopsy

• the role of saturation biopsy (random) remains unclear
• feasibility in every day practice

• detection rates:
  better detection of anterior localized tumors with the transperineal approach, otherwise no difference

• complications related to serious infection:
  transrectal 3-5%
  transperineal < 1%

Linder, J Urol 2013
Bjurlin, J Urol 2013
Hossak, J Urol 2012
# Indication and patient flow

<table>
<thead>
<tr>
<th>Suspicion of PCa</th>
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<td>PSA elevation</td>
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<tr>
<td>DRE</td>
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<tr>
<td>active surveillance</td>
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3T mpMRI

| Interdisc. review | conturing of ROIs |

MRI-TRUS fusion biopsy

<table>
<thead>
<tr>
<th>registration of TRUS 3D model</th>
<th>MRI-TRUS fusion</th>
<th>target and template (12x) biopsies</th>
<th>Saving of DICOM img 3D model incl. exact cores taken</th>
</tr>
</thead>
</table>
Results Bern (Artemis Eigen)

• since Jan 2014
• 120 patients
• 92 patients with lesion in MRI (76%)
• no significant cancer in patients with normal MRI
• median of 2 lesions per patient and 18 bx
• 68 patients (56%) with positive biopsies

Sonn, Margolis, Marks, Eur Urol 2013
MR-TRUS fusion biopsy

• detection rates > 50%

• accordance of stage compared to RPx specimen 95%

• concordance Gleason score 90%

• deflection of systematic sextant biopsies 1mm (freehand TRUS 9mm)

Radtke, Boxler J Urol 2015
Baco, Eur Urol 2014
Han, J Urol 2013
Set up
Set up
Set up
Video biopsy
Prostate cancer risk inflation as a consequence of image-targeted biopsy of the prostate

Fig. 4 – Detection of all cancer, and clinically significant disease, using 12-core transrectal ultrasound (TRUS) biopsy and a 3- or 4-core targeted strategy. CCL = cancer core length.

Robertson, Eur Urol 2013
Wrap up...

- more precise diagnosis with MR-TRUS fusion biopsy
- should be considered in initial diagnosis setting
- number of biopsy sessions and number of cores will be reduced in the future

problems to be solved:
- overdiagnosis of insignificant disease
- further improvement of MRI (e.g. detection small lesions)
- algorithms for treatment decisions need to be adapted
- cost-effectiveness studies need to follow
Thank you!
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