MR GUIDED PROSTATE BIOPSY
Overview

- Introduction
  - Background on standard biopsy method (TRUS)
  - Clinical indication for MR guided biopsy
- Materials and methods
  - Patient preparation
  - Biopsy material
  - Biopsy technique
- Case examples
- Future perspectives
Introduction

- Standard prostate biopsy method:
  - Transrectal ultrasound guided (TRUS) biopsy
    - Random
    - Systematic

- Optimal number of cores 10-18* (depending mostly on prostate volume, but also on age and digital rectal examination (DRE) findings)

* Chun et al. Eur Urol 2010
Introduction

- TRUS Biopsy scheme options

Axial planes

16-cores

14-cores

14-cores

10-cores

* Chun et al. Eur Urol 2010

Best biopsy scheme option depends on age, volume, and DRE
Introduction

Prostate cancer (PCa) risk remains non-negligible even after multiple prior saturation biopsy sessions

- Detection rate on initial TRUS biopsy 23%-42%
- Detection rate on repeat biopsy ~ 30%
- Third session ~ 18%, fourth session ~ 14% etc.

Extended TRUS biopsy scheme disadvantage, more insignificant tumors

* Chun et al. Eur Urol 2010
Introduction

- MR imaging guided prostate biopsy, advantages
  - Use of diagnostic MR imaging for planning
    - Targeted biopsy, lesser biopsy cores per patient
  - Use of MR imaging for biopsy
    - Excellent soft tissue contrast
Introduction

- Use information provided by MR imaging
  - To visually transfer → TRUS
    - Spatial misregistration
  - Automated fusion systems are underway (eg, TRUS-MRI fusion)*

* Singh et al. BJU Int 2008
Biopsy with TRUS – MRI fusion
Hit the most aggressive lesion

with TRUS – MR (ADCmap) fusion
Introduction

- Biopsy approaches
  - Transperineal
  - Transgluteal
  - Transrectal
Introduction

- Transrectal approach advantageous, because
  - No need for anaesthetics*

  “Pain from transrectal ultrasound-guided biopsy of the prostate is well tolerated with no anesthesia.”

  - Technically easier to perform due to shorter pathway*²

Introduction

- When to perform MR guided prostate biopsy*
  - Clinical suspicion and PSA > 4ng/mL
  - At least one previous negative TRUS session
  - Biochemical recurrence after radiotherapy*²


*² Yakar et al. Invest Radiol 2010
3T MR-biopsy

- >1 neg. biopsy: TRUS pos. in 5-19%
- MR-GB of TSR positive in 59% (40/68)
- 57% anterior tumors
- 93% clinically significant
- 4 cores instead of 12
Materials and Methods

- Patient preparation
  - Anticoagulation medication?
    - If yes, then INR should be 1.5-2.0
  - Endocarditis profylaxis?
    - Previous endocarditis, cardiac valve protheses, certain congenital cardiac disease
    - If yes, then → amoxicilline 2 gram iv, 30-60 minutes prior to biopsy
  - Standard profylaxis
    - Ciprofloxacilline (3 times 500 mg)
Materials and methods

- MR scanner
- Biopsy device
- Needle guider
- Biopsy needle
Materials and methods

- Biopsy session
  - Start with, 3D estimation of location of cancer suspicious region (CSR) on previous diagnostic MR images

* Yakar et al. Topics in MRI 2008
Materials and methods

- Position patient on MR table
  - Prone position
  - Insert needle guider (use chlorhexidine/lidocaine gel)
  - Attach it to biopsy device
  - Place pelvic phased array coil on buttocks
Materials and methods

- Move patient into MR scanner
- Instruct patient not to move!
Materials and methods

- Start scanning
  - Determine needle guider position (TRUE-FISP images)
Materials and methods

- Obtain T2 weighted axial image for 3D re-localization
Materials and methods

- Recommendable to obtain DWI, to target most aggressive area
This patient had a history of 9 negative TRUS sessions!

- 72 y.o.
- PSA 22 ng/mL
- Received therapy with Casodex!!!
- Histopathology revealed PCa with Gleason grade 3+5
Materials and methods

- Biopsy patients with suspicion of post radiotherapy (RT) recurrence
- By using dynamic contrast enhanced (DCE) MRI

TRUS guided biopsy $\rightarrow$ Positive Predictive Value (PPV) $27\%^*$

- DCE-MRI guided biopsy $\rightarrow$ PPV 86% / 74%
- Median of 3 cores per patient

* Yakar et al. Invest Radiol 2010
*² Crook et al. Int J Radiat Oncol Biol Phys 1993
Examples: Post radiotherapy recurrence

Case 1:
69y, RT 2,5 y before, PSA 2.08 ng/mL

Case 2:
68y, RT 2 y before, PSA 1.65 ng/mL
Examples: Post radiotherapy recurrence

Case 3:

69y, RT 13 y before, 
PSA 25.00 ng/mL

Both biopsies contained PCa (Gleason 3+4 and 3+3)!
Future prospects

Optimizing biopsy process

- Most time spent on adjusting needle guider towards target area
- Ideally, remote controlled needle guider movements