MRI/US Fusion for Prostate Cancer

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Introduction

Prostate cancer (PCa) is a heterogeneous disease, with indolent and aggressive forms.

The traditional elements used for risk stratification and management of PCa patients include:

• Clinical H&P and digital rectal exam (DRE)
• Prostate-specific antigen (PSA) test
• Gleason results from 10-12 core extended sextant biopsy
Why MRI-US Fusion?

Transrectal ultrasound (TRUS) guided biopsy is standard of care for the diagnosis of prostate cancer.

Benefits:
• Established procedure
• Can be performed in the office setting

Limitations:
• TRUS biopsies may (over)detect indolent PCa
• Significant Gleason understaging
• Undersampling of anterior gland, transition zone
Why MRI-US Fusion?

Prostate magnetic resonance imaging (MRI) is the most accurate imaging method for the detection and staging of prostate cancer.

• Initial use was for staging PCa patients
• Increasing role in evaluating patients with suspicion of PCa, planning biopsy, etc.

Limitations:
• Learning curve, operator dependent
• Expensive
MRI-TRUS Fusion Biopsy
Pre Biopsy

Lesion Identification

Prostate Segmentation

Lesion Volume of Interest

MRI-TRUS Fusion Biopsy

Biopsy Procedure

Prostate Segmentation

Lesion VOI Projection

Biopsy Mapping

MRI-TRUS Fusion Biopsy
Post Biopsy

MRI-US fusion targeted biopsy data suggest potential improvements over standard biopsy

- Targeted approach detects more higher grade PCa over standard biopsy alone (32%)
- Targeted approach detects more clinically significant (Gleason ≥ 4+3) disease (67%) and missed lower grade (Gleason ≤ 3+4), potentially indolent disease (36%).
- Standard biopsy also led to upgrading (26%) but detected less clinically significant disease (only 8% Gleason ≥ 4+3).

MRI-US Fusion Biopsy Results

Recent systematic review reveals similar findings

• 15 studies with >2000 patients
• Median detection rate for “clinically significant disease” in standard biopsy was 23.6% (range: 4.8-52%)
• Median detection rate in targeted biopsy was 33.3% (range: 13.2 - 50%).
• “Clinically significant” was variably defined.

Role of MRI-US Fusion Biopsy

NCCN Guidelines* suggest a role for MRI

- Post 2 negative TRUS biopsies
- In high risk pts with negative biopsy results

Challenges include:

- Cost and availability
- Heterogeneity of existing approaches, techniques
- Impact upon pre-existing risk stratification methods

Emerging Role of MRI-US Biopsy

Incorporation in Current Risk Stratification
• Biopsy naïve patients?
• Standard biopsy negative patients?

Specific Patient Groups
• Role in active surveillance?
• Focal therapies?
• Role in previously treated disease?
On the Horizon

Computer Aided Detection & Classification

MRI-US Fusion Biopsy starts with MRI

• Changing classification schemes
• Changing emphasis on MRI sequences

Evolving computer aided detection and classification methods are poised to have a greater role in multiparametric prostate MRI.

Over the Horizon
Novel PET Imaging Agents

Next Generation PSMA Tracers
- $^{18}$F-DCFPyL
- $^{68}$Ga-HBED-CC

PET-MRI-US Fusion Biopsy
- Fusion technology is straightforward
- “Killer Application” for PET/MRI?


Summary

MRI-US fusion targeted biopsy data suggest potential improvements over standard biopsy.

Specific role and patients are currently not well defined.

Multisite trials are needed to help answer many of the remaining questions.
Selected References


5. Prostate Cancer Early Detection, Version 1.2014 *NCCN Clinical Practice Guidelines in Oncology*,
Questions?

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Thank You