

Outcomes of Serial MRI-Fusion Biopsy in Men with Low-Risk Prostate Cancer Managed with Active Surveillance

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Abstract

The outcomes and utility of serial magnetic resonance imaging (MRI)/ultrasound (US) fusion targeted prostate biopsy in men with prostate cancer (PCa) on active surveillance (AS) have not been clearly defined. We sought to investigate the rate of Gleason upgrading both on sequential fusion targeted and systematic biopsies among men with low-risk PCa managed with AS.

We retrospectively queried an institutional database of 840 patients undergoing MRI/US fusion biopsy to identify 249 patients on AS with at least two fusion biopsies between December 2013 and November 2016. Men with National Comprehensive Cancer Network (NCCN) very low-risk and low-risk criteria were included. Gleason upgrade was defined as detection of Gleason score $\geq 3+4$. The proportion of patients experiencing upgrade on systematic, fusion, or both biopsy techniques was tabulated. Associations of clinical, pathologic, and imaging factors with biopsy upgrade were analyzed by logistic regression.

Of 249 patients on active surveillance, 92 (37.0%) had at least two MR-US fusion guided biopsies (66% very low-risk and 34% low-risk PCa). The median time between biopsies was 13.0 months (IQR 11.6–17.4). The median PSA and PSA density were 5.5 ng/mL (IQR 4.3–7.2) and 0.12 ng/mL/mL (IQR 0.08–0.18), respectively. 27 (29%) patients experienced Gleason upgrade on subsequent MR-guided biopsy. Of those, 8 (9%), 9 (10%), and 10 (11%) had upgrade on systematic biopsy only, fusion biopsy only, and both systematic and fusion biopsy, respectively. Neither baseline PIRADS score nor change in lesion size was associated with Gleason upgrade. In multivariable logistic regression model, greater number of positive cores in systematic biopsy (OR 1.53; 95% CI 0.94–2.50; $p=0.09$) was associated with the total Gleason upgrade on repeated biopsy.

In men with favorable risk prostate cancer managed with AS, Gleason upgrade was detected in 29% of patients on a second MRI/US fusion biopsy including both targeted and systematic regions. Both MRI-ultrasound fusion biopsy and systematic biopsy detected Gleason upgrade in a subset of patients that would have been missed if either technique were performed alone. These findings support the continued use of both MRI fusion and systematic biopsy during surveillance due to risks of reclassification over time.

Background

Background:

- It is well validated that multiparametric MRI (mpMRI) can help determine candidacy for initial surveillance vs treatment in prostate cancer (PCa)¹
- There is evidence that stable mpMRI findings on active surveillance (AS) have a low likelihood of pathologic progression

Unmet need:

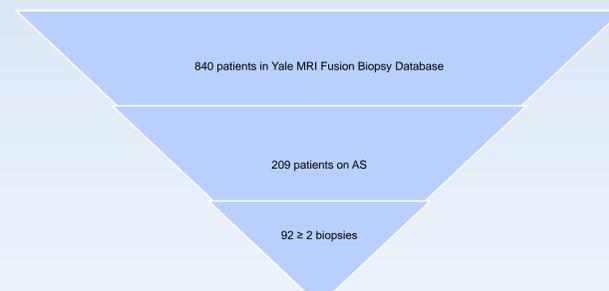
- The utility of MRI in the initial setting is well validated, however, the utility of sequential MRI for patients on AS has yet to be established

Aim:

- To investigate the rate of Gleason upgrading both on serial MRI fusion targeted and systematic biopsies among men with low-risk PCa managed with AS

Methods

- We retrospectively queried an IRB-approved Yale MRI Fusion Biopsy Database of 840 patients undergoing MRI-ultrasound (MRI-US) fusion biopsy
- Of this cohort, we identified 249 patients on AS with Gleason 3+3 and Very Low-Risk or Low-Risk Pca as defined by National Comprehensive Cancer Network criteria (NCCN)
- 92 patients on AS with at least two fusion biopsies or patients on AS prior to their first MRI and biopsy between December 2013 and November 2017
- mpMRI imaging was performed using a 3-T MRI system with a multichannel phased array surface coil without an endorectal coil and read by experienced GU radiologists



- Patients were offered enrollment in an institutional active surveillance protocol on the basis of NCCN risk Pca
- Primary outcomes: Gleason upgrade defined as pathological detection of Gleason score $\geq 3+4$
- Secondary outcomes: number of lesions, total suspicion score, number of positive cores on initial biopsy, highest percent positive of core

Patients on AS are older (63) and had a median time between biopsy of 12.6 months.

Table 1 Patient Demographics	Total (n=92)	
Median Age	62	(57-68)
Median PSA	5.5	(4.3-7.2)
Median PSA Density	0.12	(0.08-0.18)
Median time between biopsy	13.0	(11.6–17.4)
NCCN Very Low Risk	61	66%
NCCN Low Risk	31	34%
Stage - T1c	64	88%
Stage -T2a	9	12%
Race - White	86	94%
Race - Other	6	6%

MR-US fusion biopsy demonstrated both systematic and targeted biopsy detected Gleason upgrade

Table 2 mpMRI, MR-US fusion biopsy, and pathological progression	Total (n=92)	
mpMRI Progression in score	23	25%
mpMRI Progression in lesion number	23	25%
Number of cores positive on initial biopsy (systematic)	1	(0-2)
Highest core percentage (systematic)	25%	(5%-50%)
Number of cores positive on initial biopsy (targeted)	1	(0-3)
Highest core percentage (targeted)	30%	(10%-50%)
Gleason Biopsy Upgrade	27	29%
<i>Systematic</i>	8	9%
<i>Targeted</i>	9	10%
<i>Both</i>	10	11%

MRI PIRADS score progression is not significantly associated with Gleason Upgrade

Table 3 Gleason upgrade vs. MRI Score Progression	No MRI Progression	MRI Progression
No Gleason Upgrade	76.9%	23.1%
Gleason Upgrade	72.5%	29.6%

$p=.509$

Results

In multivariable regression, mpMRI and MR-US findings are not significant predictors of Gleason upgrade

Table 4: Patient demographics and clinical characteristics in Gleason Upgrade (n=92)	Univariate			Multivariate		
	OR	95% CI	P value	OR	95% CI	P value
Age	1.06	0.99-1.13	0.08			
Race	5.48	0.94-31.95	0.06			
PSA	1.16	1.01-1.34	0.03	1.24	0.93-1.66	0.16
PSA Density	1.96	1.06-3.62	0.03	0.89	0.32-2.50	0.83
Time between biopsies	0.98	0.92-1.04	0.44			
mpMRI Progression in Lesion #	0.59	0.2-1.81	0.36			
mpMRI Progression in Lesion Score	1.40	0.51-3.84	0.51			
Positive Systematic Cores	1.64	1.19-2.26	0.01	1.53	0.94-2.50	0.09
Highest Percent Positive Systematic Core	1.02	1-1.04	0.04	1.01	0.98-1.04	0.49
Targeted Cores Proportion positive	1.00	0.84-1.18	0.97			
Positive Targeted Cores	0.99	0.78-1.27	0.96			
Highest Percent Positive Targeted Core	1.00	0.98-1.02	0.86			
Highest Baseline PIRADS Score	1.34	0.93-1.93	0.11			

Conclusion

- Our study aimed to investigate the rate of Gleason upgrading both on serial MRI fusion targeted and systematic biopsies among men with low-risk and very-low risk PCa managed with AS
- Among men with low risk prostate cancer on AS undergoing serial MRI, 29% experienced change in MRI characteristics, including number of lesions and total suspicion score
- Gleason upgrade was detected in nearly one-third of patients, including both MRI targeted and systematic biopsy
- On multivariable analysis, number of positive cores on initial biopsy was associated with risk of subsequent upgrade
- These findings support the continued use of MRI fusion and systematic biopsy during surveillance due to risks of reclassification over time.

References

- Felker et al. Serial Magnetic Resonance Imaging in Active Surveillance of Prostate Cancer: Incremental Value. J Urology 2016
- Diaz et al. Use of serial multiparametric magnetic resonance imaging in the management of patients with prostate cancer on active surveillance. J Urol Oncol 2015
- Johnson et al. Multi-parametric MRI as a management decision tool. Transl Androl Urol. 2017
- Pinto et al. Magnetic resonance imaging/ultrasound fusion guided prostate biopsy improves cancer detection following transrectal ultrasound biopsy and correlates with multiparametric magnetic resonance imaging. J Urol. 2011
- Vourganti et al. Multiparametric magnetic resonance imaging and ultrasound fusion biopsy detect prostate cancer in patients with prior negative transrectal ultrasound biopsies. J Urol. 2012