

Improved detection of higher risk prostate cancer by MRI-targeted versus standard template ultrasound-guided biopsy

INTRODUCTION

- The majority of new prostate cancer (PCa) diagnoses made in the United States occur via transrectal ultrasound (TRUS) guided systematic template prostate biopsy (“standard biopsy”).
- Since this modality depends on random sampling of the organ, which may lead to undersampling of aggressive disease in addition to detection of low-risk PCa with concomitant harms of overtreatment, there is a demand for more reliable and accurate diagnostic methods.
- Multiparametric magnetic resonance imaging (MP-MRI) of the prostate can identify lesions suspicious for PCa, and platforms using software fusion of pre-acquired MRI with real-time TRUS (“MRI-targeted biopsy”) are now FDA-approved.
- The goal of this project is to assess whether MRI-targeted biopsy detects a significantly greater proportion of higher-grade, clinically-significant disease as compared to standard biopsy (“upgrading”) in patients who underwent both approaches.

METHODS

- Prospective cohort study of men undergoing both MRI-targeted and standard biopsy from the National Cancer Institute (NCI) and UT Southwestern from 2007 to 2017.
- Pathology was categorized by the International Society of Urological Pathology (ISUP) grading scheme and compared between targeted biopsy and concurrent standard biopsy with McNemar’s test.
- Parameters associated with upgrading, determined by threshold $p < 0.15$, were evaluated in multivariable logistic regression models where significance was defined as $p < 0.05$.

RESULTS

Table 1:

Parameter	Entire cohort	NCI	UTSW	p
Patients, no.	1913	1673	240	-
Age at biopsy, years	63 (58-68)	63 (58-68)	64 (59-69)	0.07
Prior prostate biopsy	1494 (78%)	1388 (83%)	106 (44%)	<0.0001
Prior negative biopsy	684 (36%)	630 (38%)	54 (23%)	<0.0001
Race				
Asian	66 (3%)	56 (3%)	10 (4%)	0.5
Black	271 (14%)	255 (15%)	16 (7%)	0.0002
Hispanic	30 (2%)	24 (1%)	6 (3%)	0.3
Other/unknown	39 (2%)	36 (2%)	3 (1%)	0.5
White	1507 (79%)	1302 (77%)	205 (85%)	0.007
MRI volume, mL*	50 (36-69)	51 (37-72)	41 (31-55)	<0.0001
MRI targets, no.†	4 (2-6)	4 (2-6)	4 (2-5)	<0.0001
PSA, ng/mL	6.7 (4.6-10.2)	6.7 (4.5-10.3)	6.7 (5-9.8)	0.6
PSA density, ng/mL ²	0.13 (0.09-0.21)	0.13 (0.08-0.20)	0.17 (0.11-0.24)	<0.0001

*Available for 1767 patients.

†Refers to targets which were biopsied. At UTSW PI-RADS 1 and 2 lesions were not biopsied.

		MRI-targeted						Totals
		No cancer	ISUP Grade Group					
			1	2	3	4	5	
Standard template ISUP Grade Group	No cancer	678	71	71	20	27	6	873
	1	150	148	100	17	17	3	435
	2	59	51	177	32	26	3	348
	3	9	4	18	30	19	0	80
	4	7	3	17	8	68	11	114
	5	3	0	2	1	8	49	63
Totals		906	277	385	108	165	72	1913

Table 3:

Parameter	Univariate		Multivariable	
	OR	p	OR	p
Center, NCI (reference) vs UTSW	1.42 (0.91-2.24)	0.1	1.34 (0.82-2.20)	0.2
Age at biopsy, years	1.03 (1.01-1.06)	0.003	1.04 (1.01-1.07)	0.002
Prior prostate biopsy, yes/no	0.95 (0.64-1.42)	0.8	-	-
Prior negative biopsy, yes/no	0.85 (0.60-1.22)	0.4	-	-
Race				
Black, yes/no	1.22 (0.78-1.92)	0.4	-	-
White, yes/no	0.76 (0.52-1.11)	0.2	-	-
MRI volume, per mL	0.99 (0.98-0.99)	0.0005	0.99 (0.98-0.99)	<0.0001
MRI targets, per no.	1.15 (1.08-1.22)	<0.0001	1.14 (1.07-1.22)	0.0001
PSA, per ng/mL	1.02 (1.01-1.03)	0.0005	1.02 (1.01-1.03)	0.001
PSA density, per ng/mL ²	3.42 (1.96-5.97)	<0.0001	-	-

- Of 1913 men in the study, 1235 were diagnosed with PCa by either standard or targeted biopsy.
- Patients between the two centers were matched by age and PSA (Table 1) but differed by history of previous biopsy, MRI prostate volume, and racial distribution.
- 408 patients had intermediate to high grade prostate cancer diagnosed by either targeted or standard biopsy (Table 2), of whom 194 (47%) had concordant targeted and standard biopsy results.
- 151 (37%) men had intermediate to high grade disease missed or downgraded relative to targeted biopsy by standard biopsy, and 63 men (15%) were missed or downgraded relative to standard biopsy by targeted biopsy ($p < 0.0001$).
- On multivariable analysis of upgrading by targeted biopsy, when controlling for potentially confounding factors, increasing age, MRI prostate volume, number of targets and PSA remained significantly associated, whereas the performing center was not predictive.

CONCLUSIONS

MRI-targeted prostate biopsy results in greater detection of clinically significant higher-grade PCa as compared to standard biopsy. Whether MRI-targeted biopsy can be performed instead of standard biopsy, versus being performed in selected risk-stratified populations or as a supplemental technique, requires additional study.