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Original Article

Prostate cancer management choices in patients undergoing multiparametric magnetic resonance imaging/ultrasound fusion biopsy compared to systematic biopsy

Jennifer B. Gordetsky, M.D.[a,b,*], Benjamin Saylor, M.D.[a], Sejong Bae, Ph.D.[c], Jeffrey W. Nix, M.D.[b], Soroush Rais-Bahrami, M.D.[b,d]

[a] *Department of Pathology, University of Alabama at Birmingham, Birmingham, AL*
[b] *Department of Urology, University of Alabama at Birmingham, Birmingham, AL*
[c] *Division of Preventive Medicine, University of Alabama at Birmingham, Birmingham, AL*
[d] *Department of Radiology, University of Alabama at Birmingham, Birmingham, AL*

Abstract

Objectives: To assess management choices in patients who undergo magnetic resonance imaging (MRI)/ultrasound (MRI/US) fusion-guided prostate biopsy compared to patients who undergo systematic biopsy.

Methods: We compared men who underwent MRI/US fusion-guided prostate biopsy to those who underwent systematic 12-core biopsy from 2014 to 2016. Patient demographics and pathologic findings were reviewed. The highest grade group per case was considered for analysis.

Results: Follow-up was available on 133 patients who underwent MRI/US targeted biopsy and 215 patients who underwent systematic biopsy. There was no difference in prebiopsy prostate-specific antigen (PSA) (10.1 ± 10.0 vs. 12.9 ± 20.5, $P = 0.11$) between the 2 cohorts. Patients in the MRI cohort were more likely to have had a previous prostate biopsy ($P < 0.0001$). Overall, more patients in the MRI cohort choose active surveillance compared to the standard cohort (49.6% vs. 24.2%, $P < 0.0001$), confirmed on multivariate logistic regression model adjusting for age, PSA density, prior biopsy history, race, grade group, and provider ($P = 0.013$). This finding held true independently for patients with grade groups 1 and 2 tumors ($P = 0.02$ and $P = 0.005$, respectively) and in a multivariate logistic regression model adjusting for grade group 1 and 2 tumors ($P = 0.0051$). In the standard cohort, more patients chose radiation over prostatectomy (47.2% vs. 24.4%, $P < 0.0001$). On multivariate analysis, race was an independent predictor of active surveillance, with African Americans less likely to undergo active surveillance.

Conclusions: Patients who undergo MRI/US targeted biopsy are more likely to choose active surveillance over early definitive treatment compared to men diagnosed on systematic biopsy when adjusting for tumor grade, PSA density, prior biopsy history, race, and provider.

Keywords: Prostate cancer; Multiparametric MRI; Grade groups; Treatment; Active surveillance

1. Introduction

For years, the standard-of-care approach for diagnosing prostate cancer has been the extended sextant biopsy, which is essentially a systematic but random tissue sampling of the prostate gland. Prostate cancer remains the only solid organ malignancy that is standardly detected through such a random approach. Multiparametric magnetic resonance imaging (MRI)/ultrasound (US) fusion-targeted prostate biopsy has recently come onto the scene in prostate cancer detection. Instead of a random sampling of the prostate gland, this technology strives to target suspicious lesions found on MRI for biopsy under real-time US guidance. Several studies have shown that MRI/US targeted biopsy detects more clinically significant prostate cancers compared to standard biopsy alone [1–6]. As such, more academic institutions and community urology groups have adopted this technique in their practice.

* Corresponding author. Tel.: +12059754696; fax: +12059755242.
E-mail address: jgordetsky@uabmc.edu (J.B. Gordetsky).

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The introduction of any new technology needs to be evaluated in terms of its impact on patient care. The era of prostate-specific antigen (PSA) screening brought about an increase in the detection of prostate cancer overall. However, this increased incidence of prostate cancer led to an increase in the detection of early staged, low-grade tumors that are often considered clinically insignificant. As such, there has been a shift in philosophy among the urologic community in terms of the management of prostate cancer. Many clinicians advocate for active surveillance (AS) or minimally invasive therapies for the treatment of organ confined, low-volume, low-grade disease [7–11]. The introduction of MRI/US targeted biopsy could further impact patients in the management of prostate cancer, specifically in their selection of AS vs. definitive treatment [12]. Our study assessed management choices in patients who underwent MRI/US fusion-guided prostate biopsy compared to patients who underwent a systematic biopsy approach.

2. Methods

Our prospectively maintained prostate biopsy database was reviewed between January 2014 and December 2016. Men who underwent MRI and MRI/US fusion-guided prostate biopsy with concurrent 12-core extended-sextant transrectal ultrasound (TRUS)-guided biopsy were identified. This cohort is referred to as the "target cohort." In addition, patients who underwent only standard 12-core extended-sextant TRUS-guided biopsy were also identified. This cohort is referred to as the "standard cohort." Patients were referred for suspected prostate cancer, which included elevated serum PSA level or abnormal digital rectal examination. Some patients had previously diagnosed low-grade tumors. For patients who had a standard biopsy performed at UAB and initially chose AS followed by MRI-targeted biopsy at a later date, the management choices that these patients made were recorded in their respective groups. Patients who had a previous positive biopsy performed at an outside institution followed by targeted biopsy at UAB were only included in the target cohort, as the charts from the outside institutions were not available for review as a part of this study. Patient demographics, insurance status, and pathologic findings were reviewed. More than 80% of patients in both cohorts had management discussions with one of 2 urologic oncologists.

Our institutional protocol for MRI consists of triplanar T2-weighted imaging, diffusion weighted imaging with calculated apparent diffusion coefficient map, and dynamic contrast enhanced MRI. Prostate Imaging Reporting and Data System (PIRADS) scores were assigned based upon the most recent version of PIRADS available at the time of the MRI study. At our institution, targeted biopsy is most commonly performed in patients with at least 1 lesion scored with a PIRADS 3 or greater. A minority of patients who have low suspicion via imaging parameters but have high clinical suspicion undergo targeted biopsy with lower PIRADS scoring.

All patients in the target cohort underwent MRI to identify areas within the prostate gland suspicious for prostate cancer. Patients in both cohorts then proceeded to standard-of-care, systematic 12-core extended-sextant TRUS-guided biopsy, including 2 cores (lateral and medial) from each sextant region. Patients in the target cohort additionally underwent targeted biopsy of MRI-identified lesions using the UroNav (Philips/InVivo, Gainsville, FL) MRI/US fusion biopsy platform. All biopsies of MRI/US targeted lesions were performed by one of 2 urologic oncologists with at least 2 cores sampled from each MRI-targeted lesion as previously recommended [13]. The overall prostate cancer grade group for each biopsy session was based on the core with the highest grade group in each case. Prostate cancer grade groups were defined as follows: Gleason score $\leq$ 6: grade group 1, Gleason score $3 + 4 = 7$: grade group 2, Gleason score $4 + 3 = 7$: grade group 3, Gleason score 8: grade group 4, Gleason score 9 to 10: grade group 5 [14]. All pathology was reviewed by a single fellowship trained genitourinary pathologist.

All continuous variables are expressed as means with standard deviations and compared using Student *t*-test comparison while categorical variables are expressed as counts and percentages and compared with chi-squared test with Fisher exact modification for categorical values with low proportion incidence in the dataset. Multiple variable logistic regression was used to examine relationships between characteristics and AS choice. Type III analysis of effect *P* values were calculated in order to examine overall categorical differences across race and other covariates in the model. In our multivariable model, we examined multicollinearity of covariates using the variance inflation factor threshold of 5. Statistical analyses were performed using SAS v9.4, where statistical significance was considered if *P* values were less than 0.05.

3. Results

A total of 280 patients were identified that underwent systematic TRUS-guided 12-core sextant extended biopsy plus MRI/US targeted biopsy, of which 149 (53%) had cancer detected. Of this cohort, 16 were lost to follow-up, leaving 133 patients available for evaluation of management decisions in the target cohort. A total of 376 patients were identified who underwent only standard TRUS-guided 12-core extended sextant biopsy, of which 225 (60%) had cancer detected. Of this cohort, 10 were lost to follow-up, leaving 215 patients available for evaluation of management decisions in the standard cohort (Fig). The clinical and pathologic features of the patients excluded from our cohort are presented in Supplemental Table 1.