National Survey of Patterns Employing Targeted MRI/US Guided Prostate Biopsy in the Diagnosis and Staging of Prostate Cancer

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Key Words
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Abstract

Background/aims: Targeted magnetic resonance imaging/ultrasound (MRI/US) guided biopsy is an emerging technology that has the potential to change standard of care for the diagnosis and management of prostate cancer. This technology is rapidly proliferating, however quantitative analysis of these trends are unavailable. The objective of this study was to assess urologist opinions regarding implementing MRI/US imaging into their practices. Methods: A questionnaire was distributed using research electronic data capture and completed by 291 practicing urologists within the United States registered through the American Urological Association. The survey gathered information regarding demographics, changes in MRI use, opinions on targeted MRI/US guided biopsy, and barriers to implementation. The survey results were analyzed using ANOVA. Results: Practice setting and geographic region were significantly associated with implementation of MRI/US guided biopsy. Total 72\% of urologists in academic centers report using MRI/US targeted biopsy, compared to 38\% in solo private practice. In the northeast 68\% of urologists report using MRI/US biopsy, compared to 44\% in the western United States. Conclusion: While there are some reservations about employing MRI/US guided biopsy as standard of care in all prostate biopsies, the data suggests urologists support its use, and are making efforts to introduce targeted MRI/US guided biopsy into their practice. Regional and practice setting variations exist in implementation.

Introduction

Prostate cancer is the second most commonly diagnosed cancer among men, with an estimated 160,000 new cases reported in 2016 \cite{1}. Given this high incidence, it is necessary to develop screening and diagnostic tests that are both highly sensitive and specific. Prostate specific antigen (PSA) screening has been widely used in the detection of early stage malignant neoplasms, but has also increased detection of benign lesions \cite{2} sometimes leading to unnecessary invasive treatments and increased healthcare costs \cite{3}. Men with an elevated PSA or abnormal digital rectal exam suspected of having prostate cancer undergo biopsy, which traditionally is...
The ability to overlay MP-MRI images in real time on MRI/Ultrasound (MRI/US) guided platforms provides upgrading [5]. Even more recently the combination of high grade lesions [4], as well as decrease the risk of over the last decade has helped to identify potentially onance imaging (MP-MRI) for imaging of the prostate may be missed or incorrectly stratified.

The introduction of multiparametric magnetic resonance imaging (MP-MRI) for imaging of the prostate over the last decade has helped to identify potentially high grade lesions [4], as well as decrease the risk of upgrading [5]. Even more recently the combination of MRI/Ultrasound (MRI/US) guided platforms provides the ability to overlay MP-MRI images in real time on TRUS, and thus perform more targeted biopsies. This targeting allows for the diagnosis of more high-risk cases and fewer low-risk cases of prostate cancer in comparison to standard sextant biopsy [6, 7], as well as track lesions over time with imaging or repeat biopsy, through active surveillance (AS) [8, 9]. Targeted MRI/US guided biopsy is an emerging technology that has the potential to change standard of care for the diagnosis and management of prostate cancer. It is believed that the implementation of this technology has expanded in recent years, however quantitative analysis to describe these trends is not available. In order to address this question we developed a survey to distribute to urologists across the United States. The primary objective of this study was to assess the ways in which urologists employ MRI in their prostate cancer practices, as well as assess attitudes regarding the role of MRI/US guided biopsy.

### Materials and Methods

#### Questionnaire

A 20-question survey was generated and managed online using Research Electronic Data Capture, a secure web-based application designed to support data capture and research studies [10] to 7,341 practicing urologists within the United States who were registered members of the American Urological Association (AUA). The questionnaire gathered information regarding demographics, current and recent changes in MRI use, opinions on targeted MRI/US guided biopsy, and barriers to implementation. The survey was distributed August 22, 2016, and was left open until September 12, 2016, at which point the survey was closed. One email reminder was distributed in the interim to increase responses.

#### Data Analysis

Results of the survey were imported and analyzed in ANOVA. Chi square analyses were used to assess variability in responses between demographic groups.

#### Results

Total 291 (4%) of practicing urologists completed the survey representing a sampling margin of error of ± 5.6% for reflecting the opinions of the entire cohort. Respondents were primarily trained in general urology (60%) or urologic oncology (22%) and well represented across age, practice type, geographic location, and volume of prostate biopsies performed monthly (table 1). The survey participant population shares a similar demographic distribution to annually published demographic information put forth by the AUA [11], and notably does not contain a disproportionate percentage of urologic oncol-

### Table 1. Demographic distribution of survey respondents

| Categorization                        | Responses n (%) |
|---------------------------------------|-----------------|
| Specialty (fellowship training)       |                 |
| General urology                        | 175 (60%)       |
| Urologic oncology                      | 63 (22%)        |
| Endourology                            | 17 (6%)         |
| Male infertility/andrology             | 6 (2%)          |
| Female urology/urodynamics             | 6 (2%)          |
| Pediatrics                             | 4 (1%)          |
| Other                                  | 18 (6%)         |
| Age                                    |                 |
| Under 30 years old                     | 0 (0%)          |
| 31–40 years old                        | 55 (19%)        |
| 41–50 years old                        | 83 (29%)        |
| 51–60 years old                        | 90 (31%)        |
| 61–70 years old                        | 42 (14%)        |
| Over 70 years old                      | 20 (7%)         |
| Practice type                          |                 |
| Academic center                        | 84 (29%)        |
| Solo private practice                  | 26 (9%)         |
| Group private practice                 | 113 (39%)       |
| Multi-specialty group                  | 53 (18%)        |
| Other                                  | 14 (5%)         |
| Geographic region                      |                 |
| Northeast                              | 96 (33%)        |
| South                                  | 70 (24%)        |
| Midwest                                | 69 (24%)        |
| West                                   | 50 (17%)        |
| Other                                  | 4 (1%)          |
| Average prostate biopsies performed monthly |          |
| None                                   | 16 (5%)         |
| 1–5 biopsies                           | 90 (31%)        |
| 6–10 biopsies                          | 96 (33%)        |
| 11–15 biopsies                         | 47 (16%)        |
| 16–20 biopsies                         | 17 (6%)         |
| Greater than 20 biopsies               | 22 (8%)         |

There are 291 practicing urologists responding to the survey. Respondents were sub-categorized and analyzed by specialty, practice type, geographic region, and average number of prostate biopsies performed monthly. The absolute number, percentage of overall respondents, and population proportionate confidence intervals respectively, are displayed.
ogists (22% in this cohort vs. 21% in the AUA survey) who would be expected to perform the most MRI/US guided prostate biopsies.

Participants were asked several questions regarding the extent to which they used MRI in their practice to diagnose and manage prostate cancer. Table 2 summarizes general MRI use, MRI use for MRI/US guided biopsy, MRI use for AS of suspicious lesions or low grade malignancy, and MRI use for pre-prostatectomy imaging. Forty-six percent of respondents reported using MRI prior to diagnostic biopsy and 9% reported using MRI for focal therapy (Suppl. table 1), but no significant differences in MRI use between demographic groups were found for these modalities. Overall 86% of respondents currently employ MRI in some capacity in their practice. More specifically 60% report using MRI for MRI/US guided biopsy, 66% for AS, and 38% for pre-prostatectomy imaging. Practice setting was a significant factor in MRI use as academic centers reported the greatest utilization of targeted biopsy (72%), and solo practitioners the least (38%, \( p = 0.004 \)). Academic centers also reported the greatest use of MRI for AS (82%, \( p < 0.001 \)) and pre-prostatectomy imaging (58%, \( p < 0.001 \)). When analyzed by geographic region, the northeast demonstrated greater use of MRI (92%) in MRI/US targeted biopsy (68%), AS (72%), and pre-prostatectomy imaging (48%) relative to other regions in the United States. Urologists practicing in the western United States reported the least amount of MRI use (76%) for MRI/US targeted biopsy (44%, \( p = 0.02 \)), AS (50%, \( p = 0.006 \)), and pre-prostatectomy imaging (28%, \( p = 0.006 \)).

With increased evidence in the literature in recent years suggesting a role for MRI, we asked participants how the use of MRI in their practice has changed over the past 5 years. Figure 1a provides a summary of participant responses. Sixty-seven percent of respondents report increased use of MRI for MRI/US guided biopsies, while 33% reported no change or reduced use. Seventy-four percent of respondents reported increased MRI use for AS, while 26% reported no change or reduced use. For pre-prostatectomy imaging, 42% report increased MRI use, and 58% reported no change or decreased use. Figure 1b provides a summary of this data.

The implementation of emerging technologies often requires significant resources, as well as the ability to overcome additional barriers. Sixty percent of respondents reported working for an institution or group with the resources to perform MRI/US guided biopsies. When further analyzed by practice setting, 71% of urologists at academic centers reporting having the necessary resources to perform MRI/US guided biopsies, compared to 60% in multi-specialty groups, 53% in group private practice, and 35% in solo private practice (\( p = 0.002 \) (fig. 2). Of the 126 (47%) respondents who are using a
software platform for MRI/US guided biopsy 83% are using UroNav, 10% are using Artemis, 6% are using Urostation, and 1% BioJet (Suppl. table 2). Urologists who did not possess the resources necessary to perform MRI/US targeted biopsies were then asked to list the specific barriers to implementation of this technology. Sixty-nine percent of respondents cited cost as a barrier to implementation, followed by 36% who cited insurance coverage issues, and 36% cited lack of necessary infrastructure/trained personnel.

Fig. 1. Changes in MRI Use. Participants were asked how their use of MRI imaging in their practice has changed in the past 5 years with regards to MRI/US guided biopsy, AS, and pre-prostatectomy imaging.

| Practice type           | Treated by in past 5 years | p = 0.002 CL [53.4–64.6] |
|-------------------------|---------------------------|-------------------------|
|                         | yes                       | no                       |
| n = 169                 | n = 116                   |
| Academic                | 59 (71%)                  | 25 (29%)                 |
| Multi-specialty group   | 32 (60%)                  | 21 (40%)                 |
| Group private practice  | 60 (53%)                  | 15 (47%)                 |
| Solo private practice   | 9 (35%)                   | 17 (65%)                 |

Fig. 2. Resources to implement MRI/US targeted biopsy technology.
Figure 3 demonstrates urologist opinions on the appropriate setting for MRI/US guided biopsy, given the significant barriers to implementation and the increased cost. Twenty-four percent of respondents feel there is sufficient evidence to employ MRI/US as standard of care in all prostate biopsies, while 65% believe MRI/US should be reserved for more select cases such as men with elevated PSAs and prior negative biopsies. Ten percent of respondents believe there is insufficient evidence to transition from standard extended sextant biopsy at this time, and 2% of respondents see no reason to transition beyond standard extended sextant biopsy. Finally, participants were asked if MRI/US guided biopsies increase their confidence that patients with suspected prostate cancer are appropriately stratified into risk assessment groups. Thirty-six percent of respondents report significantly increased confidence, 38% moderately increased confidence, 21% minimally increased confidence, and 6% report no change in confidence with MRI/US biopsy (Suppl. table 3).

**Discussion**

This survey sought to measure the use of MRI, and more specifically urologist implementation of MRI/US guided biopsy into the diagnosis and staging of prostate cancer. MRI was shown to be a valuable tool as 86% of respondents currently employ MRI in some capacity in their practice. To date there has been one national survey [12], which assessed urologist opinions on the use of MP-MRI for diagnosing prostate cancer. This study had a similar response rate (3.9%) and found access and cost limited the widespread use of MP-MRI beyond academic centers. When the survey was distributed (2013) only 34% of urologists reported utilizing cognitive or ultrasound guided biopsies. While our results cannot be directly compared to the previous study, when our survey was distributed in 2016, 47% of urologists reported utilizing an ultrasound fusion platform and 60% reported using some form of guided biopsy, including cognitive fusion. This is further supported by urologists reports of 74 and 67% increased use of MRI for AS and guided biopsies respectively over the past 5 years. This suggests that MRI/US guided technologies continue to be implemented into practice as they become accessible and the literature develops to support its use.

Interestingly geographic region was a significant factor in use of MRI/US guided biopsy with 68% utilization in the northeast compared with 44% in the west. This may represent differing opinions between institutions on the value of MRI/US technology or may reflect the use of MRI/US fusion biopsy as a means for practices to remain competitive in tighter markets. It may be some time before there is uniform consensus on the role of MRI, but there will likely be an increasing familiarity with these modalities in residency and continuing education programs throughout the United States as academic centers lead the way of implementing the use of MRI in prostate cancer diagnosis and management.

Within subpopulations of respondents, urologists at academic centers demonstrated the greatest use of MRI/US targeted biopsy (71%). The results suggest this is due to greater resources and investment in research, as only 35% of those in solo private practice, and 53% of those in group practice report having the resources to perform MRI/US targeted biopsies compared with 71% at academic centers. As would be expected with an emerging technology, cost was the most common barrier to implementation. One literature review cited mixed results when investigating the economics surrounding MRI/US fusion biopsies, but stated the upfront cost of MRI/
US fusion platforms and the cost of incorporating MRI into regular screening and AS for a disease as prevalent as prostate cancer would have to be addressed before it would be feasible for widespread use [13].

While attitudes towards implementation of MRI/US guided biopsy are generally positive, there are some reservations about employing MRI/US universally. The majority of respondents (65%) believe MRI/US should be reserved for select cases such as men with prior negative biopsies, and not as standard of care in all patients. MRI/US guided biopsy has been shown to be particularly effective in detecting clinically significant tumors in this subset of patients with clinical suspicion of cancer but a negative standard biopsy [14, 15]. Overall the data suggests urologists support the use of MRI/US guided biopsy, and at a minimum MRI/US should be utilized in complex patients where primary biopsy does not fit with the overall clinical picture.

This survey has several limitations. Since the survey was optional, there may have been some selection bias introduced in terms of those who chose to participate, particularly urologic oncologists who may see more cases of prostate cancer and, thus be more familiar with or have a more favorable opinion of MRI/US guided biopsy. Additionally, like any survey, participant responses were limited to the available choices. While we left an “other” option where it was appropriate, responses outside this scope were difficult to quantify and may have introduced error into the study.

**Conclusion**

Regional and practice setting variations exist in the adaptation of this technology. While there are some reservations about employing MRI/US guided biopsy for all men with suspicion of prostate cancer, the data suggests urologists support its use, and are making efforts to introduce targeted MRI/US guided biopsy into their practice.

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**Suppl. Table 1.** MRI use by modality

| Categorization                  | Value | CI    |
|---------------------------------|-------|-------|
| Pre-biopsy imaging              | 132 (46%) | 40.3–51.7 |
| MRI/US guided biopsy            | 172 (60%) | 54.4–65.6 |
| AS                              | 188 (66%) | 60.2–71.4 |
| Focal therapy                   | 26 (9%) | 5.8–12.2 |
| Pre-prostatectomy imaging       | 109 (38%) | 32.5–43.5 |

Survey participants were asked in what capacity they use MRI in their practice. Results are displayed as absolute number of responses, percentages, and population proportionate confidence intervals respectively.

**Suppl. Table 2.** MRI/US platform

| Categorization       | Value | CI    |
|----------------------|-------|-------|
| Artemis              | 14 (10%) | 4.8–15.2 |
| UroNav               | 106 (76%) | -0.7–2.7 |
| UroStation           | 4 (3%) | 76.5–89.5 |
| Other                | 16 (11%) | 2.6–11.4 |

Survey participants who reported using MRI/US guided technology were asked which platform they use for their biopsies. Results are displayed below as absolute number of responses, percentages, and population proportionate confidence intervals respectively.

**Suppl. Table 3.** Patient risk stratification confidence following MRI/US guided biopsy

| Categorization | Value | CI    |
|----------------|-------|-------|
| Not at all     | 17 (6%) | 3.3–8.6 |
| Minimally      | 59 (20%) | 15.5–24.5 |
| Moderately     | 109 (38%) | 32.5–43.5 |
| Significantly  | 104 (36%) | 30.6–41.4 |

Survey participants were asked if MRI/US guided biopsies increased their confidence that patients with suspected prostate cancer are appropriately stratified into risk assessment groups. Results are displayed below as absolute number of responses, percentages, and population proportionate confidence intervals respectively.

**Suppl. Fig. 1.** Monthly Prostate MRIs Performed. Participant responses regarding monthly MRIs performed or ordered in their practice. Graphical display (a) and summary table (b) with absolute number of respondents and percentages displayed respectively.

**Suppl. Fig. 2.** MRI/US fusion platform utilization. Participants who reported performing MRI/US guided biopsies using image guided software (n = 126, 47%, 95%CI 41.4–52.6) were then asked which software fusion platform they used in their practice. Responses regarding platform use by region are displayed graphically with absolute number of responses (a) by region. Summary table (b) with absolute number of responses and percentages are displayed respectively.