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Original contribution

Defining the optimal method for reporting prostate cancer grade and tumor extent on magnetic resonance/ultrasound fusion–targeted biopsies☆,☆☆

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Summary Magnetic resonance (MR)/ultrasound fusion–targeted biopsy (TB) routinely samples multiple cores from each MR lesion of interest. Pathologists can evaluate the extent of cancer involvement and grade using an individual core (IC) or aggregate (AG) method, which could potentially lead to differences in reporting. We reviewed patients who underwent TB followed by radical prostatectomy (RP). TB cores were evaluated for grade and tumor extent by 2 methods. In the IC method, the grade for each TB lesion was based on the core with the highest Gleason score. Tumor extent for each TB was based on the core with the highest percent of tumor involvement. In the AG method, the tumor from all cores within each TB lesion was aggregated to determine the final composite grade and percentage of tumor involvement. Each method was compared with MR lesional volume, MR lesional density (lesion volume/prostate volume), and RP. Fifty-five patients underwent TB followed by RP. Extent of tumor by the AG method showed a better correlation with target lesion volume ($r = 0.27$, $P = .022$) and lesional density ($r = 0.32$, $P = .008$) than did the IC method ($r = 0.19$ [$P = .103$] and $r = 0.22$ [$P = .062$]), respectively. Extent of tumor on TB was associated with extraprostatic extension on RP by the AG method ($P = .04$), but not by the IC method. This association was significantly higher in patients with a grade group (GG) of 3 or higher ($P = .03$). A change in cancer grade occurred in 3 patients when comparing methods (2 downgraded GG3 to GG2, 1 downgraded GG4 to GG3 by the AG method). For multiple cores obtained via TB, the AG method better correlates with target lesion volume, lesional density, and extraprostatic extension.

1. Introduction

For years, the standard of care for the detection of prostate cancer has relied on elevated prostate-specific antigen (PSA) and/or abnormal digital rectal examination results [1,2].

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Abnormal results on either screening test would most commonly lead to a transrectal ultrasound (US)–guided systematic 12-core extended sextant biopsy. However, this technique uses a nontargeted approach to identify the presence of prostate cancer. In this way, prostate cancer remains the only solid organ malignancy sampled in such a random, but systematic fashion for diagnosis.

Multiparametric magnetic resonance (MR)/US fusion–targeted biopsy has been shown in the past to be equivalent in terms of overall prostate cancer diagnosis but superior for clinically significant prostate cancer diagnosis when compared with the random, extended sextant prostate biopsy approach while using fewer needle cores [3-7]. In addition, recent studies have shown MR/US fusion–targeted biopsy to be superior in terms of diagnosing higher grade, clinically significant prostate cancers [6,8]. As such, this new technology is becoming more frequently adopted within both academic and community practices. Targeted prostate biopsies typically attempt to sample multiple cores from each lesion of interest, and therefore, the pathology report addresses the conjunct material for grade and extent of cancer involvement.

Accordingly, we sought to investigate how this approach would impact prostate cancer reporting. One option is for pathologists to evaluate the extent of cancer involvement and Gleason score on a per-core basis, as is currently recommended by the International Society of Urological Pathology Grading Committee and the 2016 World Health Organization *Classification of Tumours of the Urinary System and Male Genital Organs*, which was developed based on a systematically distributed sampling through the prostate gland [9,10]. Alternatively, pathologists could evaluate the entire aggregate of prostate tissue taken from a single MR-targeted lesion and give an overall grade and tumor extent. This approach is currently recommended in cases where there is prostate cancer involvement of multiple fragmented cores in one container [10]. These different methods could potentially lead to different percentages of cancer involvement and/or Gleason score reporting. The most appropriate method for evaluating MR/US fusion–targeted biopsy has yet to be studied to date. Herein, we compare these 2 different methods of histologic evaluation of MR-targeted prostate biopsies to see which method best corresponds with radical prostatectomy (RP) findings.

2. Materials and methods

An institutional review board–approved retrospective review of our prospectively maintained database on patients who underwent MR/US fusion–targeted biopsy with subsequent RP from 2014 to 2017 at the University of Alabama at Birmingham was performed. Image processing and targeting of lesions at the time of biopsy was performed using the UroNav system (Phillips/InVivo, Gainsville, FL). PI-RADS v2 scoring was assigned by a multidisciplinary consensus conference with fellowship-trained radiologists and urologic oncologists specializing in prostate MR, all with more than 3 years of experience with prostate MR (Fig. 1). Two fellowship-trained urologic oncologists performed all MR/US fusion–targeted biopsies and RP. Each targeted lesion was sampled by at least 2 needle cores as recommended based on prior publication [11]. More extensive sampling is conducted in some cases based on the size and location of lesions to ensure adequate sampling of the lesion, which is codependent on lesion size, proximity to other targeted lesions, and ease of coregistration between prebiopsy MR imaging (MRI) with real-time transrectal US at the time of the fusion biopsy procedure [12]. The MR/US fusion–targeted prostate cores were evaluated for Gleason score and percent tumor extension, per each MR lesion, by 4 methods as described below (Fig. 2).

2.1. Individual core with discontinuous extension

This method evaluated prostate tissue from MR/US fusion–targeted lesions on a traditional, per-core basis. Gleason score for each MR/US fusion–targeted lesion was based on the core with the highest score. The measure of tumor involvement for each MR/US fusion–targeted lesion was determined by the single core with the highest extent of tumor. The percentage of Gleason pattern 4 for each MR/US fusion–targeted lesion was based on the core with the highest percentage of pattern 4. By this method, for cores with discontinuous cancer foci, intervening benign tissue was considered as if it were involved by prostate cancer.

2.2. Individual core with no discontinuous extension

This method evaluated prostate tissue from MR/US-targeted lesions on a per-core basis. Gleason score for each MR/US fusion–targeted lesion was based on the core with the highest score. The measure of tumor involvement for each MR/US fusion–targeted lesion was determined by the single core with the highest extent of tumor. The percentage of Gleason pattern 4 for each MR/US fusion–targeted lesion was based on the core with the highest percentage of pattern 4. By this method, for cores with discontinuous cancer foci, intervening benign tissue was considered noninvolved tissue.

2.3. Aggregate of cores with discontinuous extension

This method evaluated prostate tissue from MR/US fusion–targeted lesions by unifying all cores from a single MR-targeted lesion as fragments of a single sampling. Areas of tumor representation from all cores were aggregated as a part of the final overall Gleason score for each for each MR/US fusion–targeted lesion. In this method, for cores with discontinuous cancer foci, intervening benign tissue was considered as if it were involved by prostate cancer. The percentage of tumor involvement was calculated as the amount