cancer usually has a low apparent diffusion coefficient (ADC) value on DWI and enhances more and shows a faster washout than normal prostatic tissues on DCE-MRI [6, 7]. Although preoperative tissue diagnosis of prostate cancer has been performed using TRUS-guided biopsy, this procedure is limited by its relatively low sensitivity for the detection of prostate cancer [8, 9]. Anterior prostate cancer, which is cancer located anterior to the urethra in the transition zone (TZ) or in the anterior fibromuscular stroma, is frequently missed even with 10- to 12-core extended systematic biopsies [10, 11]. Anterior prostate cancer accounts for approximately 20% of all prostate malignancies [10] and tends to be located in the apex, where the positive surgical margins frequently oc-

**Anterior Prostate Cancer: Diagnostic Performance of T2-Weighted MRI and an Apparent Diffusion Coefficient Map**

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**OBJECTIVE.** Diagnosis of anterior prostate cancer is challenging. The purpose of this study was to evaluate the diagnostic performance of T2-weighted imaging and an apparent diffusion coefficient (ADC) map in the detection of anterior prostate cancer and to compare that with the diagnostic performance in the detection of posterior prostate cancer.

**MATERIALS AND METHODS.** We retrospectively reviewed the records of 87 patients who underwent 3-T MRI that included T2-weighted imaging and diffusion-weighted imaging before radical prostatectomy. The prostate gland was divided into anterior and posterior segments, and the radiologists interpreted two protocols (T2-weighted imaging alone vs T2-weighted imaging and an ADC map) and sorted the confidence levels for the presence of prostate cancer into five grades. ROC analysis was performed to evaluate the diagnostic performance of each protocol for the detection of anterior and posterior prostate cancers. We also assessed the relative fractions of sensitivity and specificity between anterior and posterior prostate cancers. Additionally, the ADCs of noncancerous anterior fibromuscular stroma were measured and compared with the ADCs of anterior prostate cancers.

**RESULTS.** The AUCs with T2-weighted imaging alone and with T2-weighted imaging and an ADC map were 0.75 and 0.88 for anterior prostate cancer, respectively, and were 0.70 and 0.81 for posterior prostate cancer. The sensitivity for detecting anterior prostate cancer was 90% and was significantly higher than that for detecting posterior prostate cancer in the protocol using T2-weighted imaging and an ADC map (p = 0.003) when scores of 3–5 were considered as positive for prostate cancer. The ADC was significantly lower in anterior prostate cancer (mean, 0.80 × 10−3 mm²/s) than in noncancerous anterior fibromuscular stroma (1.13 × 10−3 mm²/s) (p < 0.001).

**CONCLUSION.** The protocol using T2-weighted imaging and an ADC map showed higher accuracy for the detection of anterior prostate cancer than for the detection of posterior prostate cancer.

Prostate cancer is still the most commonly diagnosed nonskin cancer and is the second or third leading cause of cancer death among men in economically developed countries [1]. The clinical diagnosis of prostate cancer is based on serum prostate-specific antigen (PSA) evaluations, digital rectal examination, and transrectal ultrasound (TRUS)–guided biopsy. MRI of the prostate gland provides excellent anatomic information and has been considered a useful tool for the detection and prediction of local extension of prostate cancer. In the past decade, multiparametric MRI techniques, including DWI and dynamic contrast-enhanced MRI (DCE-MRI), have been proven to improve prostate cancer detection [2–5]. Prostate cancer usually has a low apparent diffusion coefficient (ADC) value on DWI and enhances more and shows a faster washout than normal prostatic tissues on DCE-MRI [6, 7]. Although preoperative tissue diagnosis of prostate cancer has been performed using TRUS-guided biopsy, this procedure is limited by its relatively low sensitivity for the detection of prostate cancer [8, 9]. Anterior prostate cancer, which is cancer located anterior to the urethra in the transition zone (TZ) or in the anterior fibromuscular stroma, is frequently missed even with 10- to 12-core extended systematic biopsies [10, 11]. Anterior prostate cancer accounts for approximately 20% of all prostate malignancies [10] and tends to be located in the apex, where the positive surgical margins frequently oc-

**KEYWORDS:** apparent diffusion coefficient, diagnosis, DWI, MRI, prostate neoplasms

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cur [12–14]. Furthermore, Wright and Ellis [15] reported that the most common site of a single prostate cancer was the anterior apex. Thus, early diagnosis of anterior prostate cancer is clinically important.

Watanabe et al. [16, 17] showed a high positive predictive value (PPV) for anterior prostate cancer using a targeted biopsy strategy based on an ADC map. More recently, Volkin et al. [18] reported that MRI-ultrasound fusion–guided biopsy detects significantly more anterior prostate cancers than TRUS-guided biopsy. With the advent of MRI-ultrasound fusion–guided biopsy and of MRI-guided biopsy, there has been increasing interest in defining the morphologic and imaging features of anterior prostate cancer [16–20]. However, the diagnostic performance of DWI limited to anterior prostate cancer has not been fully investigated, although there have been many DWI studies of prostate cancer in the whole prostate gland. Thus, the purpose of this study was to evaluate the diagnostic performance of a protocol of T2-weighted imaging and an ADC map for the detection of anterior prostate cancer and to compare these findings with those obtained for the detection of posterior prostate cancer. In addition, although 25% of anterior prostate cancers are confined to the anterior fibromuscular stroma [12], we have sometimes experienced difficulty in discriminating anterior prostate cancer from noncancerous anterior fibromuscular stroma on T2-weighted imaging alone. Thus, we also aimed to compare ADC values between anterior prostate cancer and noncancerous anterior fibromuscular stroma.

Materials and Methods

Patient Population

Our institutional review board approved this retrospective study and deemed that patient informed consent was not required. Between June 2007 and September 2011, a total of 117 consecutive patients who underwent preoperative MRI on a 3-T scanner followed by radical prostatectomy were initially recruited. From this series of 117 patients, 11 patients were excluded because the raw datasets of DWI were unavailable. Seven patients with severe distortion of the images due to large amounts of air and peristalsis of the rectum were also excluded. In addition, 12 patients were excluded because the histopathologic specimens were inadequate (i.e., < 5 step sections or pathologists did not mark the cancerous regions). Thus, the final study population was composed of 87 patients. One patient had a history of transurethral resection of the prostate.

MRI

All MRI examinations were performed on a 3-T scanner (Achieva, Philips Healthcare) with a 6-channel phased-array coil. An intramuscular injection of 1 mg of glucagon (Glucagon G Novo, Eisai) was administered before scanning. The examinations included the following sequences: axial and coronal T2-weighted imaging (TR/TE, 4238/70; matrix size, 512 × 260; zero-filled interpolation [ZIP] 1024; slice thickness, 3.5 mm; interslice gap, 0.1 mm; FOV, 160 × 160 mm; 2 excitations); axial T1-weighted imaging with fat suppression (enhanced T1-weighted high-resolution isotropic volume excitation; TR/TE, 3.8/1.9; flip angle, 15°; matrix size, 240 × 194 [ZIP 512]; slice thickness = 3.0 mm [ZIP 1.5 mm]; interslice gap, 0.1 mm; FOV, 160 × 160 mm; 2 excitations); axial T1-weighted imaging with fat suppression (enhanced T1-weighted high-resolution isotropic volume excitation; TR/TE, 3.8/1.9; flip angle, 15°; matrix size, 240 × 194 [ZIP 512]; slice thickness = 3.0 mm [ZIP 1.5 mm]; interslice gap, 0.1 mm; FOV, 160 × 160 mm; 2 excitations); and axial DWI (TR/TE, 5132/40; matrix size, 80 × 80; slice thickness, 3.5 mm; interslice gap, 0.1 mm; FOV, 240 × 240 mm; 2 excitations). DWI was performed with the diffusion sensitization gradients oriented along three or-
MRI of Prostate Cancer

The ADC maps were constructed from the DWI datasets of b values 0 and 1000 s/mm² on the MRI scanner console. All images were transferred to a PACS workstation (EV Insite, PSP Corporation) and analyzed by two experienced radiologists (one with 11 years of experience in prostate MRI and one with 5 years of experience in prostate MRI) who were aware of each patient’s clinical history and serum PSA levels but were blinded to the histopathologic results. According to the previous report, the ADC maps were adjusted with the optimal window and level settings of 2400 and 1350, respectively, to facilitate detection of lesions with a low ADC [16].

The prostate gland was divided into anterior and posterior segments. The anterior prostate gland was defined as the area anterior to the prostatic urethra according to studies in the literature [10, 21] (Fig. 1). Because the central zone (CZ) surrounds the ejaculatory ducts and is located posterior to the urethra, the CZ was classified as part of the posterior prostate gland. The anterior horn of the peripheral zone (PZ) was classified as part of the anterior prostate gland. Each segment was then subdivided into right and left lobes (separated by the midline through the urethra). Thus, each prostate gland was divided into a total of four segments. For each segment, two radiologists separately assigned scores for the likelihood of cancer using the following 5-point scale: 5, definitely positive; 4, probably positive; 3, indeterminate; 2, probably negative; and 1, definitely negative. Differences in assessments between the two radiologists were resolved by consensus. First, the two radiologists assigned scores on the basis of the interpretation of T2-weighted imaging alone. After a minimum interval of 2 weeks to diminish recall bias, they then evaluated each region using a combination of T2-weighted imaging and an ADC map using the same scale. The patients were randomized for each protocol.

The diagnostic criteria of prostate cancer were determined as follows. On T2-weighted imaging, a homogeneous low-signal-intensity mass lesion without a distinct hypointense capsule was considered cancer, whereas mass lesions with distinct capsules or linear and triangular-shaped hypointense lesions were considered benign. On ADC maps, a distinct low-ADC lesion was considered cancer (Fig. 2). The MRI results were compared with the nondigitized macroscopic photographs of histopathologic specimens from prostatectomy on which the cancer foci were outlined in blue ink by board-certified pathologists; the MRI results and photographs were viewed side by side by an independent third radiologist with 5 years of experience in prostate MRI who was not involved in the initial interpretation sessions. When the histopathology in each segment was evaluated, the maximum diameters of the lesions were measured with a ruler; cancer foci with maximum diameters 5 mm or greater in histopathologic slices were considered cancer-positive, whereas cancer foci less than 5 mm were considered cancer-negative. When multiple cancers were found in one segment, only the largest lesion was selected for analysis.

Statistical Analysis

Interobserver agreement was estimated using the kappa statistic as follows: 0–0.20, poor; 0.21–0.40, fair; 0.41–0.60, moderate; 0.61–0.80, good; and 0.81–1.00, very good agreement. For the two protocols (T2-weighted imaging alone vs T2-weighted imaging and an ADC map), ROC analysis was performed to evaluate the diagnostic performance in the detection of anterior and posterior prostate cancers. The diagnostic accuracy of each protocol was determined by calculating the AUC of the ROC analysis and the corresponding 95% binominal CIs. To calculate the sensitivity and specificity of each protocol, we used two different cutoff points. First, lesions with scores of 1 or 2 were considered negative and scores of 3–5 were considered positive for the presence of prostate cancer (cutoff point A). Then, sensitivity and specificity were recalculated considering scores of 1–3 as negative and scores of 4 or 5 as positive for the presence of prostate cancer (cutoff point B). We also assessed the relative fractions of sensitivity and specificity in each protocol between anterior and posterior prostate cancers using generalized estimating equations to account for the data clustering [22]. In this estimation, statistical models were constructed in each protocol. The link function was set at log link, and an independent working correlation matrix was chosen.
Statistical comparisons of the clinical and pathologic characteristics between anterior and posterior prostate cancers were conducted using either the Mann-Whitney U test for continuous variables or the chi-square test for categoric variables. All statistical analyses were performed with dedicated software (MedCalc, version 11.6.2.0, MedCalc Software; SPSS, version 22.0, IBM Japan).

Results

The clinical and histopathologic characteristics of the patients and cancers are summarized in Table 1. Anterior prostate cancer and posterior prostate cancer were found in 55 (63.2%) and 56 (64.4%) of 87 patients, respectively. Twenty-eight patients (32.2%) had both anterior and posterior prostate cancers. Both lobes were involved in 24 patients (43.6%) with anterior prostate cancer and in 16 patients (28.6%) with posterior prostate cancer. Thus, 79 anterior prostate cancers and 72 posterior prostate cancers (i.e., 79 anterior and 72 posterior segments) were analyzed in our study. For anterior prostate cancer, 19 cancer foci (24.1%) were confined to the TZ, 23 foci (29.1%) were located in both the TZ and anterior fibromuscular stroma, 30 foci (38.0%) were confined to the anterior fibromuscular stroma, and seven foci (8.9%) were located in the anterior horn of the PZ. There were no significant differences in patient age, PSA levels, maximum diameter, extraprostatic extension, postoperative Gleason score, and positive surgical margins between patients with anterior prostate cancer and those with posterior prostate cancer.

There were two anterior prostate cancers and one posterior prostate cancer in which cancerous tissues were present in a certain segment but not at the actual location suggested on MR images. These erroneous positive results were treated as negative results. Table 2 and Figure 3 show the results of the ROC analyses for detecting anterior and posterior prostate cancers. In the T2-weighted imaging and ADC map protocol, 27 cancer foci were assigned a score of 1 or 2, including eight anterior prostate cancers and 19 posterior prostate cancers. Twenty-three of these missed lesions were small and flat, and four missed lesions involved the CZ. Significant differences in the AUCs were observed between T2-weighted imaging alone and the T2-weighted imaging and ADC map protocol for the detection of both anterior prostate cancer (p < 0.0001) and posterior prostate cancer (p = 0.0022). The sensitivity of T2-weighted imaging and an ADC map for the detection of anterior and posterior prostate cancers varied depending on the cutoff from 70.1% to 89.6% and from 52.9% to 74.3%, respectively. The interobserver agreement was moderate (κ = 0.53; standard error [SE], 0.04) for T2-weighted imaging alone and good (κ = 0.73; SE, 0.03) for T2-weighted imaging and an ADC map.

Table 3 shows the relative fractions of sensitivity and specificity for anterior and posterior prostate cancers with two different cutoff points. The sensitivity for detecting anterior prostate cancer was 1.16–1.30 times higher (depending on the cutoff point) than that for detecting posterior prostate cancer in the two protocols. The sensitivity for de-
TABLE 2: Results of the ROC Analyses for Anterior and Posterior Prostate Cancers

<table>
<thead>
<tr>
<th>Performance Value for Prostate Cancer Detection</th>
<th>Value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T2-Weighted Imaging</td>
</tr>
<tr>
<td>Anterior prostate cancer</td>
<td></td>
</tr>
<tr>
<td>AUC</td>
<td>0.75 (0.68–0.81)</td>
</tr>
<tr>
<td>Cutoff A&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.82 (0.71–0.90)</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.61 (0.50–0.71)</td>
</tr>
<tr>
<td>Cutoff B&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.30 (0.20–0.41)</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.94 (0.87–0.98)</td>
</tr>
<tr>
<td>Posterior prostate cancer</td>
<td></td>
</tr>
<tr>
<td>AUC</td>
<td>0.70 (0.62–0.76)</td>
</tr>
<tr>
<td>Cutoff A&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.63 (0.51–0.74)</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.66 (0.56–0.75)</td>
</tr>
<tr>
<td>Cutoff B&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.26 (0.16–0.38)</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.95 (0.89–0.98)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Cutoff A assumes that scores of 1 and 2 indicate negative for the presence of prostate cancer and that scores of 3–5 indicate positive for the presence of prostate cancer.

<sup>b</sup>Cutoff B assumes that scores of 1–3 indicate negative for the presence of prostate cancer and that scores of 4 and 5 indicate positive for the presence of prostate cancer.

The diagnosis of prostate cancer arising from the posterior gland is generally straightforward through the use of high PSA levels and TRUS-guided biopsy results, but anterior prostate cancer is challenging to diagnose on TRUS-guided biopsy mostly because of its location [10, 11]. Thus, anterior prostate cancer is often diagnosed after repeated negative biopsies. From this point of view, MRI should play an important role in more accurate lesion localization, especially in the detection of anterior prostate cancer; however, the diagnostic performance of ADC maps in detecting anterior prostate cancer has not been investigated in detail. In the current study, we found that the sensitivity of T2-weighted imaging and an ADC map for the detection of anterior prostate cancer was significantly higher than that for the detection of posterior prostate cancer at cutoff point A. Cutoff point A (i.e., scores 3–5 considered positive) implies the clinical importance in terms of MRI-ultrasound fusion-guided or MRI-guided biopsy because these targeted biopsies would aim at lesions suspected because of the difficulty in identifying them, and the ADC values for 14 noncancerous anterior fibromuscular stromata were not measured because of marked thinning by the compression of benign prostatic hyperplasia (BPH). The ADC values of anterior prostate cancer and noncancerous anterior fibromuscular stroma were 0.80 ± 0.15 × 10<sup>−3</sup> (mean ± SD) and 1.13 ± 0.12 × 10<sup>−3</sup> mm<sup>2</sup>/s, respectively. The ADC was significantly lower in anterior prostate cancer than in noncancerous anterior fibromuscular stroma (<i>p</i> < 0.001).

TABLE 3: Relative Fraction of Sensitivity and Specificity for Prostate Cancer Detection

<table>
<thead>
<tr>
<th>Criteria for Diagnosis of Prostate Cancer</th>
<th>Sensitivity Relative Fraction (95% CI)</th>
<th>Specificity Relative Fraction (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T2-Weighted Imaging</td>
<td>T2-Weighted Imaging and ADC Map</td>
</tr>
<tr>
<td>Cutoff A&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.63 (0.52–0.76)</td>
<td>0.77 (0.67–0.89)</td>
</tr>
<tr>
<td>Anterior prostate cancer</td>
<td>1.30 (1.05–1.61)</td>
<td>1.26 (1.15–1.38)</td>
</tr>
<tr>
<td>Posterior prostate cancer</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>&lt;i&gt;p&lt;/i&gt;</td>
<td>0.017</td>
<td>0.001</td>
</tr>
<tr>
<td>Cutoff B&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.26 (0.17–0.39)</td>
<td>0.59 (0.47–0.74)</td>
</tr>
<tr>
<td>Anterior prostate cancer</td>
<td>1.16 (0.66–2.05)</td>
<td>1.29 (0.98–1.69)</td>
</tr>
<tr>
<td>Posterior prostate cancer</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>&lt;i&gt;p&lt;/i&gt;</td>
<td>0.604</td>
<td>0.062</td>
</tr>
</tbody>
</table>

<sup>a</sup>Cutoff A assumes that scores of 1 and 2 indicate negative for the presence of prostate cancer and that scores of 3–5 indicate positive for the presence of prostate cancer.

<sup>b</sup>Cutoff B assumes that scores of 1–3 indicate negative for the presence of prostate cancer and that scores of 4 and 5 indicate positive for the presence of prostate cancer.
that show definite or equivocal findings on prebiopsy MRI. In addition, although not statistically significant, there was a trend toward a higher sensitivity for detecting anterior prostate cancer than for detecting posterior prostate cancer in the protocol using T2-weighted imaging and an ADC map at cutoff point B.

Our results revealed that the sensitivity of T2-weighted imaging and an ADC map in identifying anterior prostate cancer reached 90% at cutoff point A. Watanabe et al. [16, 17] reported that the PPV of target biopsies sampling low-ADC lesions varied depending on the location of the lesions in the prostate gland and that most of the low-ADC lesions in the anterior portion proved to be malignant. These results are consistent with our results, and we have presented here the excellent diagnostic performance of a protocol using T2-weighted imaging and an ADC map for detecting anterior prostate cancer with radical prostatectomy specimens as the standard of reference. These findings suggest that prebiopsy MRI with an ADC map should be performed to avoid missing clinically significant cancer in the anterior gland, a problem inherent in the use of TRUS-guided biopsy.

The sensitivity of T2-weighted imaging and an ADC map for the detection of anterior prostate cancer in our study was higher than that for the detection of TZ cancer reported in prior studies [23, 24]. Care should be taken to avoid considering the anterior prostate gland as being equal to the TZ. During BPH growth, the posterior third of the TZ shifts location to the posterior to the urethra [12], thus making the TZ part of the posterior prostate gland. Instead, we have focused on the anterior prostate gland where diagnosis of prostate cancer is challenging when using TRUS-guided biopsy.

There may be several reasons that T2-weighted imaging and an ADC map exhibited excellent sensitivity in detecting anterior prostate cancer in this study. One potential reason is the characteristic pattern of spread in anterior prostate cancer. In our study, 53 of 79 anterior prostate cancers (67.1%) were entirely or partially located in the anterior fibromuscular stroma (Fig. 4). This elective anterior location of TZ cancer is consistent with the observations of Chen et al. [25] and Bouyé et al. [12]. This pattern of spread in conjunction with a low ADC in anterior prostate cancer makes differentiation from stromal BPH and the diagnosis of cancer easy. Knowledge
of this pattern of spread is important for the diagnosis of anterior prostate cancer.

Our results indicate that the sensitivity for detecting anterior prostate cancer was 1.16–1.30 times higher than that for detecting posterior prostate cancer in both the protocol using T2-weighted imaging alone and the protocol using T2-weighted imaging and an ADC map. One reason may be because of the excellent sensitivity of T2-weighted imaging and an ADC map for detecting anterior prostate cancer, as detailed earlier. Another factor may be the presence of CZ cancer, which is located posterior to the urethra and thus considered to be posterior prostate cancer. We noted four missed lesions that involved the CZ of prostate gland. Because the CZ appears homogeneously hypointense on T2-weighted imaging and ADC maps [26], four CZ cancers were misinterpreted as “normal” CZ in this study (Fig. 5).

Bouyé et al. [12] explained that some of the anteromedially originating TZ cancers were pushed forward and then appeared totally excluded from the TZ during TZ growth due to BPH development, which they called “anterior fibromuscular stroma–type cancer.” In the clinical setting, it is sometimes difficult to differentiate anterior fibromuscular stroma–type cancer from noncancerous anterior fibromuscular stroma on T2-weighted imaging alone. In this study, ADCs were significantly lower in anterior prostate cancers than in noncancerous anterior fibromuscular stroma. The mean ADC value in noncancerous anterior fibromuscular stroma in this study was $1.13 \times 10^{-3}$ mm$^2$/s, which is considered lower than the previously reported ADC value in healthy PZ. To our knowledge, this study is the first to report ADC values in noncancerous anterior fibromuscular stroma. It is clinically important to recognize that the noncancerous anterior fibromuscular stroma has a relatively low ADC value that is, nevertheless, more than 1.00 mm$^2$/s and is usually higher than the ADC value in anterior prostate cancer. Moreover, in this study, T2-weighted imaging and an ADC map facilitated differentiation of anterior prostate cancer confined to the anterior fibromuscular stroma from noncancerous anterior fibromuscular stroma (Fig. 6).

Recently, targeted biopsy with real-time MRI-ultrasound fusion–guided or MRI-guided technique became feasible [18, 27, 28]. These targeted-biopsy techniques have improved the detection of prostate cancer in patients with repeated negative biopsies and elevated PSA levels. Vourganti et al. [29] and Sonn et al. [30] found that in nearly half of the patients found to have prostate cancer with MRI-ultrasound fusion–guided biopsy, the tumors were located in the anterior region of the prostate gland. In addition, most of the prostate cancers diagnosed using MRI-ultrasound fusion–guided biopsy were clinically significant lesions [30]. The high sensitivity of detecting anterior prostate cancer with T2-weighted imaging and an ADC map in this study is consistent with these previous results. Additionally, because ADC values are considered to correlate with Gleason scores [31], it is not surprising that most cancers found with targeted biopsy with the MRI-ultrasound fusion–guided biopsy technique were clinically significant.

Our study has some limitations. First, MRI did not dovetail perfectly with the histologic sections provided from radical prostatectomy, although we attempted to minimize errors through matching internal prostate structures and any identifiable BPH nodules. Additionally, the pathology examinations were performed by several pathologists, which may have caused some variation in the interpretation of the pathology findings. Second, because our study was a retrospective study with a modest sample size in a single center, there may have been selection biases, and test-retest reproducibility could not be assessed. There was a potential bias introduced by including only patients with prostate cancer who underwent radical prostatectomy. These biases may have influenced...
the results of image interpretation. Third, the MRI examinations were performed without an endorectal coil in this study, thereby limiting the signal-to-noise ratio available. In addition, calibration and quality control with an independent reference standard were not performed. Fourth, because prostate cancer foci with a maximum diameter of 5 mm or greater were considered positive, small cancer foci (< 5 mm) have been ignored in this study. However, a maximum tumor diameter of less than 5 mm almost indicates a tumor volume of less than 0.5 mm³, and these small foci are often regarded as indolent or clinically insignificant cancer, which might not need radical treatment [32, 33].

In conclusion, the ADC was significantly lower in anterior prostate cancer than in noncancerous anterior fibromuscular stroma. The protocol using T2-weighted imaging and an ADC map showed higher accuracy for the detection of anterior prostate cancer when compared with that for the detection of posterior prostate cancer.

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