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Clinicopathologic Differences Between Prostate Cancers Detected During Initial and Repeat Transrectal Ultrasound-Guided Biopsy in Korea

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Purpose: The aim of this study was to investigate clinicopathologic differences between prostate cancer (PCa) detected at initial and repeat transrectal ultrasound-guided prostate biopsy in a large Korean cohort.

Materials and Methods: From 2000 through 2012, a total of 7,001 patients underwent transrectal ultrasound-guided prostate biopsy at 6 centers in Daegu and Gyeongbuk provinces. Of these 7,001 patients, the initial biopsy was positive for PCa in 2,118 patients. Repeat biopsy was performed in 374 of the 4,883 patients with an initial negative finding and a persistently elevated prostate-specific antigen (PSA) level, nodules or asymmetry by digital rectal examination (DRE), high-grade prostatic intraepithelial neoplasia, or atypical small acinar proliferation. Numbers of biopsy cores varied from 6 to 12 according to center and biopsy date.

Results: Cancer was diagnosed in 2,118 of the 7,001 patients (30.3%) at initial biopsy and in 86 of the 374 patients (23.0%) at repeat biopsy. The repeat biopsy rate was 5.3%. Mean PSA values were 68.7±289.5 ng/mL at initial biopsy and 18.0±55.4 ng/mL at repeat biopsy ($p<0.001$). The mean number of cancer-positive cores per biopsy was 5.5±3.5 for initial biopsy and 3.0±2.9 for repeat biopsy ($p<0.001$). Mean Gleason score was 7.5±1.4 at initial biopsy and 6.6±1.3 at repeat biopsy ($p<0.001$). For detected cancers, the low-stage rate was higher for repeat biopsy than for initial biopsy ($p=0.001$).

Conclusions: Cancers detected at repeat biopsy tend to have lower Gleason scores and stages than cancers detected at initial biopsy. The present study shows that repeat biopsy is needed in patients with a persistently high PSA or abnormal DRE findings.

Keywords: *Biopsy; Gleason grading; Neoplasm staging; Prostatic neoplasms*

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INTRODUCTION

In the United States, prostate cancer (PCa) is the most common cancer in men, and it has been estimated that there were 233,000 new cases and 29,480 deaths from PCa in 2014 [1]. The prevalence of PCa in Korea quadrupled between 2002 and 2008, which was the highest increase in incidence rate shown by all forms of malignancy [2]. As such, increasing incidence rates of PCa were observed globally [3]. The frequency of transrectal ultrasound (TRUS)-guided needle biopsy has also increased. The indications for TRUS-guided needle biopsy are an elevated serum prostate-specific antigen (PSA) level, an abnormal digital rectal examination (DRE) finding, or a hypoechoic lesion in TRUS. The primary limitations of TRUS needle biopsy include failure to detect clinically significant cancer (according to the Epstein criteria), imprecise tumor risk stratification (high-risk cancers are improperly classified as

low-risk), and detection of small, low-risk clinically insignificant cancers. This diagnostic uncertainty can lead to repeat biopsy, delayed detection of significant disease, and disease overtreatment [4].

Repeat prostate biopsy must be considered when PSA is persistently elevated or clinical suspicion of PCa persists. However, there are no definitive guidelines on when or whether to repeat biopsies in patients with negative findings on an initial prostate biopsy [5]. Previous studies have shown that PCa diagnosed at repeat biopsy is smaller and less likely to be of high grade as determined by examinations of prostate needle biopsy specimens and is related to better pathological outcomes after radical retropubic prostatectomy (RRP) [6-9]. Debate remains regarding the nature of PCa diagnosed at repeat biopsy, because some authors have reported that Gleason scores, stages, and tumor volumes of PCa detected at initial and repeat biopsy are similar [10]. Furthermore, the determination of the nature of PCa diagnosed at repeat biopsy is useful when determining treatment strategy. Accordingly, in the present study, we analyzed clinicopathologic differences between PCa detected at initial and repeat biopsy.

MATERIALS AND METHODS

We retrospectively reviewed a total of 7,001 patients who underwent TRUS needle biopsy from 2000 to 2012 (inclusive) at 6 centers in Daegu and Gyeongbuk provinces. Of the patients with a negative initial biopsy finding, 374 patients with a persistently elevated PSA level, persistent nodules or asymmetry by DRE, or high-grade prostatic intraepithelial neoplasia/atypical small acinar proliferation underwent repeat biopsy. Six- or 12-core transrectal biopsy samples were taken from the peripheral zone of the prostate by using an 18-gauge needle biopsy gun under TRUS guidance.

Patients were divided into two groups by number of biopsies performed before diagnosis (initial biopsy vs. repeat biopsy). The two groups were compared with respect to PSA level, prostate volume by TRUS, number of positive cancer cores, Gleason scores, and clinical stage of PCa detected by initial and repeat biopsy. The Student t-test or the Mann-Whitney U test was used to compare continuous variables and the Pearson chi-square test was used for categorical variables. A Cox regression model was used to assess the independent values of studied variables and to calculate hazard ratios (HRs) with their 95% confidence intervals (CIs). Statistical analysis was performed with IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA), and statistical significance was accepted for p values of <0.05.

This retrospective study was approved by the Institutional Review Board of the Dongguk University School of Medicine (DUGH 13-07).

RESULTS

A total of 7,001 patients underwent TRUS needle biopsy. Of these patients, 2,118 were positive for PCa and 4,883 patients were negative at initial biopsy. Of the patients who had a negative initial biopsy, 374 patients underwent repeat biopsy. A total of 86 of these patients were positive for PCa and 288 patients were negative at repeat biopsy. The PCa detection rate was 30.3% (2,118/7,001) at initial biopsy and 23.0% (86/374) at repeat biopsy (p=0.003). Among patients in whom cancer was detected, 426 patients and 6 patients lacked data such as Gleason score, number of biopsy cores, or number of cancer cores at initial and repeat biopsy, respectively. The data from these patients were excluded.

The characteristics of the 7,001 patients stratified by number of prior prostate biopsy procedures are summarized in Table 1. Mean core numbers at initial and repeat biopsy were 10.9±2.4 and 11.2±2.2, respectively (p=0.263). Patients with PCa diagnosed at repeat biopsy were significantly younger (67.8±6.5 years vs. 70.0±8.1 years, p=0.005), had lower initial PSA (18.0±55.4 ng/mL vs. 68.7±289.5 ng/mL; median, 8.4 ng/mL vs. 13.6 ng/mL; $p<0.001$), smaller number of cancer-positive cores (3.0±2.9 vs. 5.5±3.5, $p<0.001$), and lower initial Gleason score (6.6±1.3 vs. 7.5±1.4, $p<0.001$) than did patients with PCa diagnosed at initial biopsy. Mean PSA was 68.7±289.5 ng/mL at initial biopsy and 18.0±55.4 ng/mL at repeat biopsy ($p<0.001$) (Table 1). The number of cancer-positive cores was 5.5±3.5 at initial biopsy and 3.0±2.9 at repeat biopsy ($p<0.001$). Mean Gleason score was 7.5±1.4 at initial biopsy and 6.6±1.3 at repeat biopsy ($p<0.001$), and mean pathological Gleason score was 7.1±1.0 at initial biopsy and 6.6±1.8 at repeat biopsy (p=0.11).

The clinical characteristics of the initial and repeat biopsy groups who had organ-confined disease (clinical stage $\leq$ T2) are summarized in Table 2. Patients with PCa diagnosed at repeat biopsy were significantly younger (66.8±5.9 years vs. 69.1±7.9 years, p=0.008), had a larger number of biopsy cores (11.9±1.5 vs. 11.1±2.2, p=0.001), a smaller number of cancer-positive cores (3.1±3.1 vs. 4.9±3.3, $p<0.001$), a lower cancer core/biopsy core ratio (0.3±0.3 vs. 0.5±0.3, $p<0.001$), and a lower initial Gleason score (6.5±1.2 vs. 7.2±1.3, $p<0.001$) than did patients with PCa diagnosed at initial biopsy (Table 2).

The characteristics of the initial and repeat biopsy groups who underwent radical prostatectomy are summarized in Table 3. Patients with PCa diagnosed at repeat biopsy had a larger number of biopsy cores (11.8±1.4 vs. 11.0±1.9, p=0.031), a smaller number of cancer-positive cores (2.3±2.5 vs. 4.5±2.9, $p<0.001$), a lower cancer core/biopsy core ratio (0.2±0.2 vs. 0.4±0.3, $p<0.022$), a lower initial Gleason score (6.5±1.0 vs. 7.1±1.1, $p<0.022$), and a lower pathological Gleason score (6.8±1.0 vs. 7.1±0.9, p=0.041) than did patients with PCa diagnosed at initial biopsy (Table 3). Percentages of clinical stage T1 were 43.5% and 67.7%, those of T2 were 24.7% and 12.9%, those of T3 were 15.9% and 17.8%, and those of T4 were 5.9% and 1.6% at initial and repeat biopsy, respectively (p=0.001). Percentages of pathological stage T2 or less were 65.0% and 85.7%, and those of pathological T3 or more were 35.0% and 14.3%

Table 1. Baseline characteristics

Characteristic	Initial biopsy (n=1,692)	Repeat biopsy (n=80)	p-value
Age (y)			0.005
Mean±SD	70.0±8.1	67.8±6.5	
Median (range)	70 (43–95)	67 (52–90)	
Cancer detection, n (%)	2,118/7,001 (30.3)	86/374 (23.0)	0.003
PSA (ng/mL)			<0.001
Mean±SD	68.7±289.5	18.0±55.4	
Median (range)	13.6 (0.1–5,000)	8.4 (1.2–495.9)	
PSAD			0.181
Mean±SD	1.7±7.2	0.5±1.1	
Median (range)	0.4 (0.002–118.6)	0.2 (0.04–6.57)	
Prostate volume (mL)			0.391
Mean±SD	40.4±24.1	43.1±25.7	
Median (range)	34 (10–358)	37 (7–180)	
Gleason score			<0.001
Mean±SD	7.5±1.4	6.6±1.3	
Median (range)	8 (2–10)	6 (3–10)	
No. of biopsy cores			0.263
Mean±SD	10.9±2.4	11.2±2.2	
Median (range)	12 (2–27)	12 (6–20)	
No. of cancer cores			<0.001
Mean±SD	5.5±3.5	3.0±2.9	
Median (range)	5 (1–15)	2 (1–12)	
Cancer core/biopsy core (ratio)			<0.001
Mean±SD	0.5±0.3	0.3±0.3	
Median (range)	0.5 (0.06–1)	0.2 (0.05–1)	

SD, standard deviation; PSA, prostate-specific antigen; PSAD, prostate-specific antigen density.

Table 2. Clinical characteristics of organ-confined disease (clinical stage≤T2)

Characteristic	Initial biopsy (n=1,088)	Repeat biopsy (n=50)	p-value
Age (y)			0.008
Mean±SD	69.1±7.9	66.8±5.9	
Median (range)	70 (43–95)	65 (52–84)	
PSA (ng/mL)			0.528
Mean±SD	40.3±213.0	21.2±69.7	
Median (range)	10.8 (0.05–5,000)	6.9 (1.2–495.9)	
PSAD			0.520
Mean±SD	1.0±3.8	0.6±1.2	
Median (range)	0.333 (0.002–80.67)	0.172 (0.04–6.57)	
Prostate volume (mL)			0.920
Mean±SD	39.2±22.4	38.9±18.3	
Median (range)	33 (10–230.10)	35.83 (7–99.55)	
Gleason score			<0.001
Mean±SD	7.2±1.3	6.5±1.2	
Median (range)	7 (2–10)	6 (3–10)	
No. of biopsy cores			0.001
Mean±SD	11.1±2.2	11.9±1.5	
Median (range)	12 (2–20)	12 (10–19)	
No. of cancer cores			<0.001
Mean±SD	4.9±3.3	3.1±3.1	
Median (range)	4 (1–14)	2 (1–12)	
Cancer core/biopsy core (ratio)			<0.001
Mean±SD	0.5±0.3	0.3±0.3	
Median (range)	0.4 (0.06–1)	0.167 (0.05–1)	

SD, standard deviation; PSA, prostate-specific antigen; PSAD, prostate-specific antigen density.

TABLE 3. Characteristics of patients who underwent radical prostatectomy

Characteristic	Initial biopsy (n=325)	Repeat biopsy (n=20)	p-value
Age (y)			0.589
Mean±SD	66.1±6.5	65.7±4.3	
Median (range)	66 (46–87)	65 (58–75)	
PSA (ng/mL)			0.278
Mean±SD	15.2±30.7	9.3±6.2	
Median (range)	8.4 (0.1–477.5)	6.9 (2.6–25.2)	
PSAD			0.883
Mean±SD	0.5±0.7	0.3±0.3	
Median (range)	0.3 (0.002–7.4)	0.3 (0.1–1.1)	
Prostate volume (mL)			0.591
Mean±SD	35.6±16.4	35.1±10.4	
Median (range)	31 (11.5–117.5)	34 (20–53)	
Gleason score			0.022
Mean±SD	7.1±1.1	6.5±1.0	
Median (range)	7 (3–10)	6 (4–8)	
Pathological Gleason score			0.041
Mean±SD	7.1±0.9	6.8±1.0	
Median (range)	7 (5–10)	7 (6–9)	
No. of biopsy cores			0.031
Mean±SD	11.0±1.9	11.8±1.4	
Median (range)	12 (5–20)	12 (10–16)	
No. of cancer cores			<0.001
Mean±SD	4.5±2.9	2.3±2.5	
Median (range)	4 (1–14)	2 (1–12)	
Cancer core/biopsy core (ratio)			<0.001
Mean±SD	0.4±0.3	0.2±0.2	
Median (range)	0.4 (0.08–1.0)	0.1 (0.06–1.0)	

SD, standard deviation; PSA, prostate-specific antigen; PSAD, prostate-specific antigen density.

TABLE 4. Percentages of prostate cancer detected at initial and repeat biopsy according to clinical and pathologic stage, Gleason score, and pathological Gleason score

Variable	Initial biopsy (%)	Repeat biopsy (%)	p-value
cStage			0.001
T1a–c	43.5	67.7	
T2a–c	24.7	12.9	
T3a,b	15.9	17.8	
T4	5.9	1.6	
N1–2	2.5	0	
M1	7.5	0	
pStage			0.057
≤T2	65.0	85.7	
≥T3	35.0	14.3	
Gleason score			<0.001
≤6	24.5	52.2	
7	24.6	28.4	
≥8	50.9	19.4	
Pathological Gleason score			0.030
≤6	20.0	45.0	
7	56.0	40.0	
≥8	24.0	15.0	

at initial and repeat biopsy, respectively (p=0.057) (Table 4).

These results suggested that the patients diagnosed at repeat biopsy had a more favorable clinical stage distribution than did those diagnosed at an initial biopsy. Thus, patients diagnosed with PCa at repeat biopsy had significantly higher rates of nonpalpable and organ-confined disease than did patients diagnosed at initial biopsy (Table 4). Percentages with a Gleason score of ≤6 at initial and repeat biopsy were 24.5% and 52.2%, those with a score of 7 were 24.6% and 28.4%, and those with a score of ≥8 were 50.9% and 19.4%, respectively (p=0.001). Percentages with a pathological Gleason score of ≤6 at initial and repeat biopsy were 20.0% and 45.0%, those with a score of 7 were 56.0% and 40.0%, and those with a score of ≥8 were 24.0% and 15.0%, respectively (p=0.030) (Table 4).

Percentages of PCa detected at initial and repeat biopsy according to PSA level were 6.4% and 16.3% at ≤4 ng/mL, 33.6% and 40.0% at 4.1–10 ng/mL, 20.5% and 31.2% at 10.1–19.9 ng/mL, and 39.5% and 12.5% at ≥20 ng/mL, respectively (p<0.001) (Table 5). Multivariate Cox regression analyses showed that number of cancer cores ≥2 (HR, 5.57; 95% CI, 1.35–23.07; p=0.010) was an independent predictor of high-grade cancer (Gleason score≥7) detected at repeat biopsy (Table 6).

DISCUSSION

The adoption of random prostate needle biopsy as the standard for prostate biopsy improved diagnostic accuracy significantly, but only 20% to 30% of PCa cases are diagnosed at initial biopsy; the remainder are followed clinically and possibly undergo repeat biopsies [11,12]. In Korea, Joo and Kwon [13] reported a cancer detection rate at repeat biopsy of 5.5%, which differs from our result, although the indications for repeat biopsy were similar. It is difficult to explain why initial prostate biopsy findings are negative for a cancer-bearing prostate. Several factors, such as insufficient skill of the urologist and the spatial distribution, multifocality, and size of carcinoma foci, may provide some explanation. In the present series, small tumor foci in large prostates undoubtedly contributed to false-negative biopsy findings [14]. Biopsy detection rates on the second to fifth biopsies were 28.7%, 29.8%, 26.0%, and 36.7%, respectively. Khang et al. [15] reported a detection rate for repeat prostate biopsy of 14.3% (41/287), whereas in the present study, the initial biopsy detection rate was 30.3% and the repeat biopsy detection rate was 23%.

TABLE 5. Percentages of prostate cancer detected at initial and repeat biopsy according to prostate-specific antigen level

	Initial biopsy (%)	Repeat biopsy (%)	p-value
PSA level (ng/mL)			<0.001
≤4	6.4	16.3	
4.1–10	33.6	40.0	
10.1–19.9	20.5	31.2	
≥20	39.5	12.5	

The reported clinicopathologic features of PCa detected at initial and repeat TRUS-guided biopsy are diverse. Djavan et al. [10] reported that cancer detected at repeat biopsy was similar in pathological stage and volume to cancer detected at an initial biopsy and found no differences in stage or Gleason score of the radical prostatectomy specimens obtained from patients diagnosed at initial biopsy and those diagnosed at repeat biopsy. With regard to the pathological features of PCa detected at initial and repeat biopsy, the prospective European Prostate Cancer Detection study reported no significant differences with respect to Gleason score, a percentage Gleason grade of 4/5, pathological stage, or tumor volume. In this series of over 1,000 men, despite differences in location and multifocality, the pathologic and biochemical features of cancers detected on initial and repeat biopsy were similar, which suggests near identical biological behaviors [16]. In Korea, Khang et al. [15] also reported no significant differences in clinical stage between and an initial and a repeat biopsy group and in RRP specimens found no significant difference between Gleason scores, tumor bilaterality, pathological stages, positive surgical margins, lymphovascular invasion, or perineural invasion status (p=0.212, p=0.456, p=0.459, p=0.917, p=0.991, and p=0.827, respectively). In Korea, Park et al. [8] reported that repeat biopsy was associated with a higher rate of clinical T1c disease (79.5% vs. 55.5%, p=0.001), a higher rate of pathologically organ-confined disease in RRP specimens (78.3% vs. 61.3%, p=0.003), a lower rate of a Gleason score of ≥7 (63.7% vs. 73.7%, p=0.029), a lower number of positive cores (2.3 vs. 3.1, p <0.001), and a smaller tumor volume in RRP specimens (4.4 mL vs. 7.8 mL, p<0.001). Miyake et al. [14] reported that final pathological examinations demonstrated sig-

TABLE 6. Univariate and multivariate analyses using Cox proportional hazards models for predicting factors for high-grade cancer detected at repeat biopsy

Variable	Univariate analysis		Multivariate analysis	
	Hazard ratio (95% CI)	p-value	Hazard ratio (95% CI)	p-value
Age (y)				
<65	Reference		Reference	
65–69	3.40 (0.87–13.24)	0.078	2.33 (0.30–18.01)	0.418
≥70	2.03 (0.67–6.15)	0.208	2.18 (0.41–11.53)	0.361
PSA (ng/mL)				
<4	Reference		Reference	
4–10	2.62 (0.58–11.89)	0.212	3.93 (0.27–54.25)	0.317
≥10	5.46 (1.23–24.26)	0.026	7.84 (0.41–149.25)	0.171
PSAD (ng/L/g)				
<0.15	Reference		Reference	
≥0.15	5.94 (1.59–22.20)	0.008	1.19 (0.13–11.35)	0.878
No. of cancer cores				
1	Reference		Reference	
≥2[a]	8.21 (2.68–25.17)	<0.001	5.57 (1.35–23.07)	0.010

CI, confidence interval; PSA, prostate-specific antigen; PSAD, prostate-specific antigen density.
[a]:High-grade cancer: Gleason score≥7.

nificantly smaller tumor volumes in patients diagnosed by repeat biopsy but no significant differences in the distributions of pathological T stages or Gleason scores or in the incidence of lymphatic invasion, vascular invasion, or perineural invasion. On the other hand, Steiner et al. [17] reported a significant decrease in pathologic stage and Gleason score in PCa detected at rebiopsy, despite the absence of any further decrease from the second to fifth set of biopsies. Roehl et al. [18] reported that tumors diagnosed at repeat biopsy were of a lower stage than those diagnosed at initial biopsy.

Epstein et al. [19] investigated the use of repeat sextant biopsies to evaluate the extent of PCa in patients with a previous positive biopsy. Patients in whom cancer was not discovered during repeat biopsy (31%) were found to have a higher proportion of confined or indolent tumors than patients in whom cancer was discovered during initial and repeat biopsies. Furthermore, repeat biopsy–positive but initial biopsy–negative patients have been reported to be more likely to harbor clinically insignificant PCa or indolent cancer [9]. In a European cancer detection study, the features of cancers detected at initial or second biopsies differed from those detected at third or fourth biopsies [16]. In the same study, no differences were noted when comparing the pathological characteristics of PCa detected at first and second biopsies with respect to organ confinement (p=0.15) or extraprostatic extension (p=0.22) [16]. Also in that study, PCa detected at third or fourth biopsies had lower grades, stages, and volumes than did PCa detected at first or second biopsies [16].

Yuasa et al. [9] reported that the organ-confined tumor rate was greater in patients diagnosed at repeat than at initial biopsy (73% and 44%, respectively; p=0.041) and found no intergroup differences between recurrence rates or biochemical failure-free survival.

In the present study, cancers detected at repeat biopsy tended to have lower Gleason scores and clinical stages. However, cancers detected at repeat biopsy had a greater rate of pathologically organ-confined disease (pathological stage≤T2), but this difference was not statistically significant (p=0.057). Although PCa detected at repeat biopsy had lower Gleason scores and stages, these included high-grade tumors (Gleason score≥7) or advanced disease.

Park et al. [8] reported that there were no significant differences in patient age (66.4±5.8 years vs. 67.2±3.3 years, p=0.401) [8]. In that study, the percentage of PCa samples with biopsy Gleason score≥7 was 58.1%, that with a pathological Gleason score≥7 was 63.7%, that with clinical T3 was 1.2%, and that with pathological stage≥T3 was 21.7% in the repeat biopsy group.

Ploussard et al. [20] conducted a prospective single-center cohort study, and 139 PCa cases were detected on repeat biopsy. Among those cases, 32 PCa cases had a Gleason score≥7 (23.0%). Furthermore, Tan et al. [6] reported that 38% of cancers diagnosed after 2 or more previous negative biopsies were intermediate or high grade (Gleason score 7 or greater), including 14% that were Gleason score 8–10.

In our study, the percentage of PCa with biopsy Gleason score≥7 detected at repeat biopsy was 30.7% and that with clinical T3 or greater was 19.4%, but the mean age of patients in whom PCa was detected at repeat biopsy was younger than the age of patients in whom PCa was detected at initial biopsy. Active surveillance was initially offered to patients with low-risk PCa (Gleason score 6, PSA less than 10 ng/mL, T1c/T2a), and patients over 70 were also included with a Gleason score of 3+4 or PSA level of 10–15 ng/mL [21]. However, the patients with intermediate (PSA 10–20 ng/mL or biopsy Gleason score 7 or cT2b–c) or high-risk (PSA<20 ng/mL or biopsy Gleason score 8–10 or ≥cT3a) PCa were indicated for proper treatments [22]. Therefore, the patients who were negative for initial biopsy and had a clinical suspicion of PCa should be considered for repeat biopsy for detection of missed, clinically significant PCa.

Park et al. [23] reported that the number of biopsy sessions, prostate volume, serum PSA, and age were independent predictors of clinically insignificant PCa. However, in the present study, both univariate and multivariate analysis demonstrated that only the number of cancer cores was a significant predictor for high-grade PCa at repeat biopsies (p<0.002 and p=0.01). Age was not an independent predictor in either the univariate or the multivariate analysis. PSA≥10 ng/mL and PSA density≥0.15 ng/L/g were independent predictors only in the univariate analysis.

The population of our study was larger than that of other studies about PCa detection at initial and repeat biopsy in Korea. Also, our study was conducted at multiple institutions. However, this study had several limitations. The first limitation was that this study was retrospective. Satoh et al. [24] reported that patients with a positive biopsy result had a significantly longer interval between biopsies than did patients with a negative biopsy result. In the present study, the interval between initial and repeat biopsy differed according to the patients. Also, because we reviewed data from 2000 to 2012, the biopsy protocol was not standardized, and the number of biopsy cores differed according to the institution and time of the biopsy. Bjurlin et al. [25] reported significantly higher cancer detection for 12-core schemes that applied additional laterally directed cores or 10-core schemes of the 5-region pattern. Also, 6-core schemes have been reported to have a lower cancer detection rate than 12-core schemes [11]. In the present study, however, we did not analyze the data according to the number of biopsy cores. These variables represent a potential for bias in the current study. Second, this study does not contain follow-up data after diagnosis and treatment of PCa. Thus, we could not estimate long-term oncological outcomes, including biochemical recurrence-free survival. Furthermore, our study only reviewed data about patients diagnosed with PCa at initial or repeat biopsy. Because of this, we could not estimate any variables affecting PCa detection at repeat biopsy.

CONCLUSIONS

The present study shows that PCa diagnosed by repeat biopsy tends to have a lower Gleason score, lower number of cancer cores, and lower clinical stage than does PCa diagnosed by initial biopsy. Furthermore, in such patients, additional investigations, including a detailed evaluation of radical prostatectomy specimens, should be performed for detecting missed, clinically significant PCa.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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