The importance of prostate volume in prostate needle biopsy

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ABSTRACT

Objective: Although ultrasound-guided prostate needle biopsy is the gold standard method in the diagnosis of prostate cancer, biopsy schemes and the number of repeated biopsies are still controversial today. It is known that the rate of prostate cancer decreases with increasing prostate volume. In this study, we evaluated the effects of prostate volume on cancer detection in our patient series.

Material and methods: In our clinic, data for 992 patients who had gray zone PSA levels (2.5-10 ng/mL) and whose 10 core biopsies were taken between 2004 and 2010 were evaluated. Among them, 500 patients from whom 6 to 8 biopsies were taken, whose information was lacking and who had suspicious cancer findings after digital rectal examination were excluded from the study. Patient ages, free/total PSA levels (f/TPSA), PSA densities (PSAD), Gleason scores, and prostate volumes were compared between patients with (Group 1) or without biopsy-proven prostate cancer (Group 2). Student's t-test was used for statistical analysis.

Results: According to biopsy findings, prostate cancer was detected in 74 patients while no cancer was detected in 418 patients. The mean age of Groups 1, and 2 were 65±8.6, and 64±8.1 years, respectively. The mean prostate volume in Groups 1, and 2 were 45±23 cc, and 58±26 cc, respectively.

Conclusion: In line with the literature, the average prostate volume of the prostate cancer group was significantly lower. This supports the notion that cancer detection is more probable in small prostates than in high-volume prostates.

Key words: Biopsy; prostate cancer; prostate volume.

Introduction

Following description of sextant biopsy method by Hodge et al.^[1] in 1989, transrectal ultrasound-guided (TRUS) prostate needle biopsy has an important place in the diagnosis of prostate cancer (PCa). However some studies have demonstrated that sextant biopsy technique can miss 15-31% of prostate cancers.^[2,3] Studies performed by Uzzo et al.^[4], and Karakiewicz et al.^[5] have revealed that PCa detection rate drops in high-volume prostates. Letran et al.^[6] has shown that sextant biopsy method is not suitable for prostate volumes higher than 55.6 cc.

Recently, despite development of various biopsy techniques, standard number of biopsy cores has not been determined yet. Various health care institutes apply different methods. Our aim in this study is to investigate the importance of prostate volume in the detection of prostate cancers in our patient series, and

discuss the significance of prostate volume in the light of the literature.

Material and methods

In our clinic, data of 992 patients who had gray zone PSA levels (2.5-10 ng/mL) and whose 10 core biopsies were taken between 2004 and 2010 were retrospectively evaluated. A total of 500 patients who had suspect prostate cancer as detected during digital rectal examination (DRE) or had data of only 6 or 8 core biopsies together with cases with missing data were excluded from the study. All patients underwent prostate biopsies for the first time. The patients were divided in two groups as those with biopsy-proven prostate cancer (PCa) (Group 1) or benign prostate hyperplasia (BPH) (Group 2). Age, free/total PSA ratios (f/TPSA), PSA densities (PSAD), and prostate volumes were compared.

Ten core prostate biopsies were obtained from all patients. In addition to classical sextant

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biopsy, midgland lateral, and far lateral biopsies were retrieved bilaterally (Figure 1). In the calculation of prostate volume ellipsoid formula ($0.52 \times \text{length} \times \text{width} \times \text{height}$) was used. All biopsies were performed by two urologists (ÖGD, and VÖ). For anesthesia, 10 minutes before the procedure locally transrectal lidocaine gel was used. On the day of biopsy all patients began to receive a quinolone group antibiotic which was maintained for 3 days. The procedure was performed with the patient in the lateral decubitus position using automatic biopsy gun mounted with an 18 G tru-cut biopsy needle under the guidance of ultrasound device with a 7.5 mHz biplanar probe.

Statistical analysis

For statistical analysis SPSS 16 Windows package program was used (SPSS Inc. Chicago, IL, USA). The compliance of data to normal distribution curve was evaluated by Shapiro-Wilk test. Continuous variables, and categorical data were compared using Student's t test, and chi-square test. $P < 0.05$ was accepted as statistically significant.

Results

Prostate cancer was detected. 72 (15%) out of a total 492 patients included in the study. Mean ages of the patients in Groups 1, and 2 were 65 ± 8.6 , and 64 ± 8.1 years, respectively ($p = 0.22$). Mean prostate volumes were 45 ± 23 cc, and 58 ± 26 cc in Groups 1, and 2 respectively ($p = 0.0001$).

PSADs of Groups 1, and 2 were 0.18 ± 0.10 , and 0.13 ± 0.07 ng/mL/cm³, respectively ($p = 0.0001$). F/T PSA ratios of Groups 1, and 2 were 0.17 ± 0.10 , and $0.20 \pm 0.10\%$, respectively ($p = 0.037$). Comparative data of Groups 1, and 2 are summarized in Table 1.

As a complication, in 2 patients from each group hyperfebrile state was detected which required post-procedural monitorization in the emergency service. Intravenous antibiotherapy given in the observation room decreased patients' body temperatures.

Figure 1. Schematic representation of location of core biopsies
a: Base b: Midgland c: Apex d: Lateral e: Far lateral

In none of the patients inability to urinate, macroscopic hematuria, rectal bleeding, and epididymitis was observed.

Discussion

Definitive diagnosis of prostate cancer is established with histopathological examination. Sextant biopsy technique, firstly defined by Hodge et al.^[1] in 1989 (sampling bilaterally from base, midgland, and apex on the sagittal plane) can overlook 15-30% of clinically important prostate cancers.^[7-9]

Various studies have demonstrated the impact of prostate volume on prostate cancer detection rates. Ficarra et al.^[10] recommended 8 core biopsies in patients with prostate volumes of >30 cc. In a study performed in France, Guichard et al.^[11] evaluated prostate volumes in 3 groups as <35 cc, 35-55, and >55 cc. When 12 core biopsies were obtained, cancer detection rates were detected as 45, 36, and 28 percent. In this study, authors detected significantly lower prostate volumes in the positive biopsy group. (39.7 cc vs. 46.8 cc $p < 0.01$). In a study performed by Scattoni et al.^[12] the superiority of 18 core biopsies over 12 core biopsies was demonstrated in patients with prostate volumes higher than 55 cc., while for prostate volumes smaller than 55 cc, cancer detection rates of 12, and 18 core biopsies were found to be comparable. In our clinics, from the year 2005 on, as a standard procedure 10 core biopsies were retrieved. Significantly lower prostate volumes in the prostate cancer group when compared with the BPH group, substantiate the results of abovementioned findings.

Logically, in bulky prostates, obviously higher number of core biopsies should be obtained in order to detect cancerous foci. Therefore various biopsy techniques have been developed where additional core biopsies were obtained especially from lateral regions of the prostate.^[13,14] Most of the researchers more frequently perform lateral zone sampling to raise the detection rate of the prostate cancer.^[9,15] Durkan et al.^[3] revealed that when they additionally obtained 2 core biopsies from transitional zone, and 4 core biopsies from the peripheral zone, PCA detection rate increased 19% more than that achieved with only sextant biopsy. In a study by Eskiçorapçı et al.^[16] the authors

Table 1. Comparison of patients' age, prostate volume, PSAD, and PSAD values between Groups 1, and 2

	Group 1	Group 2	p value
Age (yrs)	65 ± 8.6	64 ± 8.1	0.22
Prostate volume (cc)	45 ± 23	58 ± 26	0.0001*
PSAD ng/mL/cm ³	0.18 ± 0.10	0.13 ± 0.07	0.0001*
f/T PSA (%)	0.17 ± 0.10	0.20 ± 0.10	0.037*
PSAD: PSA density; f/TPSA: free/total PSA; * $p < 0.05$			

detected that lateral peripheral zone biopsies plus sextant biopsy increased cancer detection rate for an additional 25.5 percent. In another study 10, 12, and 13 core prostate biopsies increased cancer detection rates for an additional 25, 22, and 35 percent, respectively.^[14,17,18]

Guichard et al.^[11] reported cancer detection rates as 31.7, 38.7, 41.5, and 42.5% in 6, 12, 18, and 21 core prostate biopsies. A current study on 1.086 cases has demonstrated significantly higher detection rates in 12 core biopsies relative to 6 core biopsies.^[19] The rationale behind all these studies is that in patients with bulky prostates, increased number of core biopsies also enhance the possibility of PCa detection rates. PCa develops mostly from the peripheral zone. Sextant biopsy technique extended to encompass lateral lobes will increase our PCa detection rates. Also in our study, prostate volumes of PCa patients were lower than those of BPH patients (45 cc vs. 58 cc). Negative biopsy group had higher number of patients with larger prostate volumes. Therefore if we could increase number of cores, would we able to identify previously missed prostate cancer cases? However the case is not always so simple. In the literature, many studies have also demonstrated that bulky prostates have not any impact on cancer detection rates. In a study, the authors did not find 12 core extended biopsy more advantageous than sextant biopsy.^[20]

Ung et al.^[21] obtained 6, and 18 core biopsies from 750 patients, and analyzed the impact of the correlation between the increased number of core biopsies, and prostate volume on prostate cancer detection rates. They demonstrated that the prostate cancer detection rate decreased from 40% down to 27% with increasing prostate volume. They also indicated that cancer detection rate did not differ with increasing number of core biopsies ($p=0.77$). However, in this study, authors had predetermined a wider PSA interval (0.3–67 ng/mL). Similarly, Jones et al.^[22] revealed that saturation biopsy had not increased cancer detection rates.

Uzzo et al.^[4] revealed that cancer detection rates were significantly higher in patients with prostate volumes less than 50 cc when compared with those with more bulky prostates (38 vs. 23%).

Besides many modifications of PSA have been proposed as a guiding tool in the decision –making process for biopsy. PSAD, and f/t PSA ratio are the most frequently used parameters. In a study by Ben Benson et al. significantly higher PSAD values were detected in patients with PCa relative to BPH patients.^[23] In a more recent study the same author determined cut-off value of PSAD as 0.15 ng/mL/cm³, and pointed out to an increased PCa risk above this cut-off value.^[24] Similarly Yu et al.^[25] indicated a relatively higher PCa risk in patients with

a PSAD >0.20 ng/mL/cm³ when compared with those with a PSAD of <0.20 ng/mL/cm³ (27.9% vs. 12.9%). Also in support of this study we detected PSAD levels of 0.18±0.10, and 0.13±0.07 ng/mL/cm³ in the PCa, and BPH groups, respectively.

f/T PSA is the most prevalently used parameter in the discrimination between PCa, and BPH. In the first biopsies performed, f/T PSA ratio was indicated as an independent predictive factor in the detection of PCa.^[26–28] In majority of medical centers, biopsies have been performed in patients with PSA values between 4, and 10 ng/mL. In a multicentered prospective study, prostate cancer was detected in 56% of the patients with f/TPSAs lower than 0.10 ng/mL, while PCa was revealed in only 8% of the patients.^[29] Unfortunately f/TPSA ratio can be affected by several factors as room temperature, and larger BPH. In our study, in compliance with the literature findings lower f/T PSA ratios were detected in the PCa group (0.20±0.10 vs. 0.17±0.10 $p=0.037$).

In conclusion, increased PSA levels in patients with bigger prostates is an expected phenomenon. These patients undergo unnecessary biopsies because of their increased prostate-specific antigen values. Nowadays, in patients with PSAs within the gray zone, most frequently PSA modifications as PSAD, and f/t PSA are used as guiding tools in the decision-making process for biopsy.

In patients with relatively enlarged prostates, although with biopsy techniques using increased number of cores higher prostate cancer detection rates have been achieved, ideal number of biopsy cores are not clear-cut. To determine ideal number of cores, larger scale prospective randomized studies should be conducted.

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