Original Article

DOI: 10.4274/uob.galenos.2023.2023.6.2

Bull Urooncol 2024;23(1):29-35

Correlation Between PSA Density and Multiparametric Prostate MRI in the Diagnosis of Prostate Cancer

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Abstract

Objective: In the diagnosis of prostate cancer, only digital rectal examination and prostate-specific antigen (PSA) testing cause unnecessary prostate biopsies, excessive cost, and treatment burden. Therefore, PSA density (PSAD) and multiparametric magnetic resonance imaging (mp-MRI) of the prostate are becoming common. In this study, we aimed to investigate the predictiveness of PSAD and mp-MRI of the prostate in the diagnosis of prostate cancer, which are non-invasive diagnostic methods.

Materials and Methods: The files of 193 patients who applied to the urology outpatient clinic for approximately 5 years were reviewed and evaluated retrospectively. Serum PSAD values and prostate imaging reporting and data system (PIRADS) scores were recorded. Prostate biopsies were performed. The cut-off value for PSAD was 0.15 ng/mL/cc. Patients with <0.15 were divided into group 1, and those with ≥0.15 were divided into group 2. Patients with a PIRADS score of 3 were divided into the suspicious group, and patients with a PIRADS score of 4 or 5 were divided into the risky group.

Results: Prostate volume, PSA, and PSAD were significantly different between the benign and malignant groups. PSAD was positively correlated with the PIRADS score. Of the 123 patients with a PIRADS score of 3, 82.9% had benign prostatic enlargement (BPE) and 17.1% had prostate cancer. Of the 70 patients with a PIRADS score of 4 or 5, 45.7% had BPE and 54.3% had prostate cancer (p<0.001). Clinically significant prostate cancer rates were significantly different between the PSA score groups and were also different for PIRADS (p<0.001). The sensitivity and specificity of PSAD in the diagnosis of prostate cancer were 67.8% and 64.9%, respectively. The sensitivity and specificity of the PIRADS score in the diagnosis of prostate cancer were 64.4% and 76.1%, respectively. When these two parameters were used in combination, the specificity was 87.3% and the sensitivity was 81.4% in the presence of at least one.

Conclusion: According to the data of the study, it was concluded that PSAD and PRIDAS scores are complementary diagnostic methods in the diagnosis of prostate cancer and are indispensable elements in the diagnosis. PSAD and PRIDAS scores are important diagnostic parameters in making the biopsy decision in the diagnosis of prostate cancer and help to prevent unnecessary prostate biopsies.

Keywords: PI-RADS, prostate cancer, prostate MRI, prostate needle biopsy, PSA density

Introduction

Prostate cancer is the second most common cancer in men worldwide (1). It is the most common solid organ tumor in elderly men (2). Adenocarcinomas constitute more than 95% of prostate cancers and develop from acinar or ductal epithelial cells of the prostate glands (3). Age, genetic predisposition, metabolic and hormonal factors, diet, and infection-related factors are risk factors for prostate cancer. However, the underlying causes of its onset and progression have not been fully elucidated (4-6).

Prostate-specific antigen (PSA) has been used in addition to digital rectal examination (DRE) for prostate cancer screening since the late 1980s (7). However, serum PSA level is an organ-specific marker. It may differ not only in malignancy but also in healthy individuals depending on variables such as age, ethnicity, and prostate volume. It may also increase in benign diseases, such as prostatitis and benign prostatic enlargement (BPE), trauma, and transurethral interventions (8). High serum PSA levels in such cases lead to unnecessary prostate biopsy decisions (9). Cancer is detected in only 34% of patients undergoing biopsy because of high PSA levels (10). From another point of view, 66% of

Cite this article as: Aslanoğlu A, Saygın H, Öztürk A, Ergin İE, Asdemir A, Velibeyoğlu AF, Korgalı E. Correlation Between PSA Density and Multiparametric Prostate MRI in the Diagnosis of Prostate Cancer. Bull Urooncol 2024;23(1):29-35.

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Received: 13.06.2023 **Accepted:** 23.10.2023

biopsies performed are unnecessary. Complications related to biopsy may be observed in a certain proportion of these patients (11).

The determinants used in the biopsy decision are serum PSA levels and DRE findings. Even if these two data are used together, they cannot provide sufficient sensitivity and specificity for biopsy. Therefore, the use of PSA density (PSAD), free/total PSA ratio, PSA velocity, and multiparametric magnetic resonance imaging (mp-MRI) of the prostate to make a biopsy decision are discussed.

Prostate biopsy is performed according to the PSA, PSAD, and PRM data. In addition, mp-MRI of the prostate has been used since the 1980s as a non-invasive imaging method for the evaluation of the prostate gland and surrounding organs (12). In recent years, the use and diagnostic accuracy of mp-MRI in the detection of prostate cancer has been increasing with the development of MRI techniques (13).

The ratio of PSA to prostate volume is PSAD. With the PSAD value, it is aimed to distinguish between cancer and BPE in PSA values between 4 and 10 ng/mL. PSAD has higher sensitivity and specificity than PSA. It has a greater diagnostic potential than serum PSA alone (14).

The use of MRI has become widespread in the last 40 years. With the development of the T2-weighted mp-MRI protocol, which includes dynamic contrast imaging sequences that provide functional and anatomical imaging, its use worldwide has been increasing rapidly, especially in the last 10 years (15).

In this study, we aimed to determine the sensitivity and specificity of PSAD and mp-MRI in the diagnosis of prostate cancer and to determine the efficacy in preventing unnecessary prostate biopsies with their combined use.

Materials and Methods

The study was approved by the Sivas Cumhuriyet University Ethics Committee (decision number: 2022-03/07, date: 23.03.2022). The files of 193 patients who had a PSA value higher than 2.5 ng/mL and had histopathological data after multiparametric prostate MRI and prostate biopsy between January 2017 and December 2021 were reviewed and evaluated retrospectively. PSAD values were calculated by the ratio of serum PSA value at the time of biopsy and prostate volume measured by transrectal ultrasound during biopsy. Due to the possibility of deviation from the normal distribution and possible undocumented infectious conditions, the upper limit of PSA was determined to be 25 ng/mL. The cut-off value for PSAD was determined to be 0.15. Patients with PSAD 0.15 were divided into group 1 and patients above 0.15 were divided into group 2.

The mp-MRIs of the patients were interpreted by the Radiology Department of Cumhuriyet University using the Prostate Imaging Reporting and Data System (PIRADS) version 2 classification. According to prostate cancer risk, patients with a PIRADS score of 1 or 2 were classified as the low-risk group, patients with 3 as the intermediate-risk group, and patients with 4 or 5 as the high-risk group.

Prostate biopsies were conventionally performed with 12- and/or 16-quadrant tru-cut transrectal ultrasonography (TRUS). Patients with an International Society of Urological Pathology (ISUP) score ≥2 in the pathology result of their biopsy were diagnosed with clinically significant prostate cancer.

Patients having an active infection (acute or chronic prostatitis, urinary tract infection, etc.), taking a drug that may affect the serum PSA value, having a condition that may affect the serum PSA value (such as acute urinary retention), and undergoing interventions that may affect the serum PSA value (cystourethroscopy, transurethral resection, etc.) were excluded from the study. Patients whose pathology did not result in benign prostatic tissue or prostate cancer (atypical small acinar proliferation or high-grade prostatic intraepithelial neoplasia) were excluded from the study. TRUS prostate biopsy is not applied to patients in the low-risk group with a PIRADS score of 1 or 2 in our clinic; therefore, these patients were excluded from the study.

Statistical Analysis

The data of the study were uploaded to the SPSS 8 (ver: 22.00) program. When the parametric test assumptions were fulfilled in the evaluation of the data, the significance test of the difference between the two means was used in the independent groups when comparing the measurements obtained from two independent groups, the analysis of variance was used when comparing the measurements obtained from more than two groups, the Spearman rank correlation test was used to determine the relationships between the variables, the predictive values for the variables receiver operating characteristic (ROC) analysis was used to determine the data obtained by counting, and the chi-square test was applied to evaluate the data obtained by counting, and the error level was taken as 0.05.

Results

One hundred and 93 patients included in the study were separated according to their PSAD values. The patients were between the ages of 48 and 82 years. Group 1 (PSAD <0.15) comprised 55.9% and group 2 (PSAD >0.15) comprised 45.1% of the patients. According to mp-MRI, 63.7% of the patients had PIRADS 3, 26.4% had PIRADS 4, and 9.9% had PIRADS 5. PIRADS scores were divided into intermediate risk group (score 3) and high risk group (score 4-5), and their rates were 63.7% and 36.3%, respectively. In the biopsy pathology data, 69.4% of the patients had BPE and 30.6% had prostate cancer. Clinically significant prostate cancer (ISUP ≥2) was 17.6% of patients (Table 1).

The mean values of biopsy results of patients with BPE and prostate cancer included in the study were 65.29 and 66.95 for age, 80.84 and 57.17 for prostate volume, 8.84 and 12.29 for PSA, 0.12 and 0.24 for PSA. Prostate volume, PSA, and PSAD were significantly different between the BPE and prostate cancer groups. It was observed that the mean values of PSAD increased with the increase in PIRADS scores. These values are 0.13 for PIRADS 3, 0.18 for PIRADS 4, and 0.3 for PIRADS 5 (Table 2).

Age, PSA, PSAD, and prostate volumes of patients with prostate cancer were analyzed using the ROC analysis method. The areas under the curve were 0.609, 0.685, 0.809, and 0.257, respectively (Figure 1). These data indicate that PSAD is more

valuable and significant than other parameters in the diagnosis of prostate cancer. However, it should be noted that there is no PIRADS score, which is a categorical variable, in this ROC analysis.

PSAD groups and pathology data were compared. Biopsy results of 106 patients in group 1 (PSAD <0.15) were reported as BPE in 82.1% and prostate cancer in 17.9%. Biopsy results of 87 patients with PSAD group 2 (PSAD >0.15) were reported as BPE in 54% and prostate cancer in 46%. PIRADS scores and pathology data were compared. Biopsy results of 123 patients with PIRADS 3 were reported as BPE in 82.9% and prostate cancer in 17.1%. Of 51 patients with PIRADS 4, 52.9% were reported as BPE and 47.1% as prostate cancer. Of 19 patients with PIRADS 5, 26.3% were reported as BPE and 73.7% as prostate cancer. In the examination performed by dividing the PIRADS scores into 3 (intermediate risk) and 4-5 (high risk) groups, 82.9% of the 123 patients in the intermediate risk group had BPE and 17.1% had prostate cancer. In the high-risk group, 45.7% of 70 patients had BPE and 54.3% had prostate cancer (Table 3).

In the study, clinically significant prostate cancer rates were 4.7% in PSAD group 1 patients and 33.3% in group 2 patients. In PIRADS scores, it was 8.2% in PIRADS score 3, 29.3% in PIRADS score 4, and 47.4% in PIRADS score 5. In the PIRADS scores, clinically significant prostate cancer was observed in 8.2% of the patients in the intermediate-risk group and 34.3% of the patients in the high-risk group (Table 4). The matching of PSAD groups and PIRADS scores according to pathology data in the study is given in Table 5.

The relationship between the PSAD and PIRADS groups was evaluated according to pathology data. A statistically significant difference was found between PSAD and PIRADS in patients with biopsy results of BPE (p=0.036). 35.1% of patients with high risk according to PSAD had malignancy. According to PIRADS, 23.9% of patients with high risk had malignancy. There was no statistically significant difference between PSAD and PIRADS scores in patients with prostate cancer (p=0.815). Malignancy was observed in 67.8% of patients with high risk according to PSAD. According to PIRADS, 64.4% of patients with high risk have malignancy (Table 6).

There was a 20% positive correlation between PSAD and PIRADS scores in patients with BPE, and a statistically significant correlation was found (p=0.019). In patients with prostate cancer, a 48% positive and statistically significant correlation was found between PSAD and PIRADS scores (p=0.001) (Table 7).

The sensitivity and specificity of PSAD in the diagnosis of prostate cancer were 67.8% and 64.9%, respectively. The sensitivity and specificity of PIRADS were 64.4% and 76.1%, respectively. PSAD and PIRADS scores were used in combination, and the specificity was 87.3%. In the presence of at least one, the sensitivity was found to be 81.4% (Table 8).

Table 1. Distribution of patient data

Variable	Category	n	%
PSAD	Group 1	106	55.9
	Group 2	87	45.1
PIRADS	3	123	63.7
	4	51	26.4
	5	19	9.9
PIRADS	3	123	63.7
	4-5	70	36.3
Pathology	BPE	134	69.4
	Prostate cancer	59	30.6
Pathology	BPE	134	69.4
	ISUP =1	25	13.0
	ISUP ≥2	34	17.6

PSAD: Prostate-specific antigen density, PIRADS: Prostate image reporting and data system, BPE: Benign prostatic enlargement, ISUP: International Society of Urological Pathology

Discussion

PSA may increase because of prostate cancer. In addition, PSA may increase because of BPE, which is more common with aging. Therefore, PSAD is used to distinguish whether the PSA increase is due to cancer or BPE. the use of PSAD increases the effectiveness of PSA in the diagnosis of prostate cancer (16). Studies have indicated that prostate biopsy should be performed in patients with PSAD ≥15%. PSAD is more significant than PSA alone, especially in patients with a PSA value between 4 and 10 ng/mL (17). Boulos et al. (18) found the cancer detection rate to be 22.8% in patients with a PSAD of 15% and 9% in patients with a PSAD of 10%. In another study with a PSAD cutoff value of 15%, it was reported that the sensitivity for cancer detection was 44% and the specificity was 76% (19).

In our study, PSAD was found to be significantly higher in patients with prostate cancer than in those without cancer. The mean PSAD values of the patients were 0.12 in patients with BPE and 0.24 in patients with cancer (p=0.001, Table 2). Prostate cancer was detected in 17.9% of 106 patients with PSAD <0.15 and in 46% of 87 patients with PSAD ≥0.15 (p<0.001, Table 4). Clinically significant prostate cancer was detected in

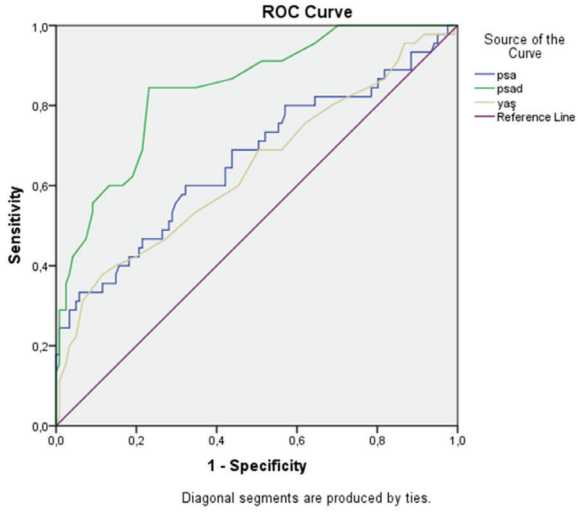

Figure 1. ROC analysis chart

ROC: Receiver operating characteristic

4.7% of patients with PSAD <0.15 and in 33.3% of patients with PSAD ≥0.15. In this respect, there was a statistically significant relationship between biopsy results and PSAD groups (p<0.001, Table 5). According to the ROC analysis results of age, PSA, and PSAD, the areas under the curve for predicting prostate cancer were calculated as 0.609, 0.685, and 0.809, respectively (Figure 1, Table 3). The study conducted in terms of the use of PSAD is similar to other studies in the literature. The sensitivity and

Table 2. Descriptive statistical results of patient data

	n	Minimum	Maximum	Mean	SD	p-value
Age						
BPE	134	48	82	65.29	5.71	0.61
Prostate cancer	59	51	82	66.95	6.94	
Prostate volume						
BPE	134	34	400	80.84	43.16	0.001
Prostate cancer	59	25	170	57.17	26.4	
PSA						
BPE	134	3	23.67	8.84	4.08	0.001
Prostate cancer	59	3.58	24.89	12.29	5.57	
PSAD						
BPE	134	0.02	0.29	0.12	0.05	0.001
Prostate cancer	59	0.08	0.62	0.24	0.13	
PIRADS 3	123	0.02	0.57	0.13	0.07	0.001
PIRADS 4	51	0.03	0.46	0.18	0.1	
PIRADS 5	19	0.07	0.62	0.3	0.16	
PIRADS 3	123	0.02	0.57	0.13	0.07	0.001
PIRADS 4-5	70	0.03	0.62	0.21	0.13	

SD: Standard deviation, BPE: Benign prostatic enlargement, PSA: Prostate-specific antigen, PSAD: Prostate-specific antigen density, PIRADS: Prostate image reporting and data system

Table 3. PSAD and PIRADS rates according to the pathology data

Variable	Category	BPE		Prostate cancer		p-value
		n	%	n	%	
PSAD	Group 1	87	82.1	19	17.9	<0.001
	Group 2	47	54.0	40	46.0	
PIRADS	3	102	82.9	21	17.1	<0.001
	4	27	52.9	24	47.1	
	5	5	26.3	14	73.7	
PIRADS	3	102	82.9	21	17.1	<0.001
	4-5	32	45.7	38	54.3	

PSAD: Prostate-specific antigen density, PIRADS: Prostate image reporting and data system, BPE: Benign prostatic enlargement

Table 4. PSAD and PIRADS rates according to ISUP data

Variable	Category	BPE		ISUP 1		ISUP ≥2		p-value
		n	%	n	%	n	%	
PSAD	Group 1	87	82.1	14	13.2	5	4.7	<0.001
	Group 2	47	54.0	11	12.7	29	33.3	
PIRADS	3	102	82.9	11	8.9	10	8.2	<0.001
	4	27	52.9	9	17.7	15	29.4	
	5	5	26.3	5	26.3	9	47.4	
PIRADS	3	102	82.9	11	8.9	10	8.2	<0.001
	4-5	32	45.7	14	20	24	34.3	

PSAD: Prostate-specific antigen density, PIRADS: Prostate image reporting and data system, ISUP: International Society of Urological Pathology, BPE: Benign prostatic enlargement

Table 5. Matching PSAD groups and PIRADS scores

Number of patients: 193			PIRADS 3 n (%)	PIRADS 4-5 n (%)	Total n (%)	p-value
PSAD	Group 1	BPE	72 (86.75)	15 (65.22)	87 (82.07)	0.049
		ISUP 1	8 (9.64)	6 (26.09)	14 (13.21)	
		ISUP ≥2	3 (3.61)	2 (8.69)	5 (4.72)	
		Total	83	23	106	
	Group 2	BPE	30 (75)	17 (36.17)	47 (54.02)	0.001
		ISUP 1	3 (7.5)	8 (17.02)	11 (12.65)	
		ISUP ≥2	7 (17.5)	22 (46.81)	29 (33.33)	
		Total	40	47	87	

PSAD: Prostate-specific antigen density, PIRADS: Prostate image reporting and data system, BPE: Benign prostatic enlargement, ISUP: International Society of Urological Pathology

Table 6. Evaluation of the concordance between PSAD and PIRADS scores according to pathology

BPE			PIRADS		Total	p-value
			3	4-5		
PSAD	Group 1	n (%)	72 (53.7)	15 (11.2)	87 (64.9)	0.036
	Group 2	n (%)	30 (22.4)	17 (12.7)	47 (35.1)	
Total		n (%)	102 (76.1)	32 (23.9)	134 (100%)	
Prostate cancer			**PIRADS**		**Total**	**p-value**
			3	**4-5**		
PSAD	Group 1	n (%)	11 (18.6)	8 (13.6)	19 (32.2)	0.815
	Group 2	n (%)	10 (16.9)	30 (50.8)	40 (67.8)	
Total		n (%)	21 (35.6)	38 (64.4)	59 (100%)	

BPE: Benign prostatic enlargement, PIRADS: Prostate image reporting and data system, PSAD: Prostate-specific antigen density

Table 7. Evaluation of the correlation between PSAD and PIRADS scores

Pathology			PIRADS
BPE	PSAD	r	0.20
		p	0.019
		n	134
Prostate cancer	PSAD	r	0.48
		p	0.001
		n	59

PIRADS: Prostate image reporting and data system, PSAD: Prostate-specific antigen density, BPE: Benign prostatic enlargement

Table 8. Prostate cancer detection rates of PSAD and PIRADS

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
PSAD	67.8	64.9	46.0	82.1
PIRADS	64.4	76.1	54.3	82.9
Combined	50.8	87.3	63.8	80.1
In the presence of at least one	81.4	53.7	43.6	86.7

PIRADS: Prostate image reporting and data system, PSAD: Prostate-specific antigen density, PPV: Positive predictive values, NPV: Negative predictive values

specificity of PSAD were found to be high compared with similar studies. We think that this is because the upper limit of PSA was 25 ng/mL in the study. According to all these data, it can be said that PSAD is a more significant parameter than PSA in predicting prostate cancer.

In recent years, with the developments in MRI techniques, the use and diagnostic accuracy of mp-MRI in the detection of prostate cancer has been increasing. In the study of Schlemmer (20), the sensitivity and specificity of MRI were found to be 80% and 90%, respectively, in detecting prostate cancer. In the study of John et al. (21), in which 131 patients with PSA values between 2.1 and 64 were examined, clinically significant prostate cancer was found in 11.1% of those with PIRADS 3 lesions, in 42.9% of those with PIRADS 4 lesions, and in 35.6% of those with PIRADS 5 lesions.

As the PIRADS lesion score increased, both the incidence of cancer and clinically significant prostate cancer increased. In total, 17.1% of 123 patients with PIRADS 3 lesions, 47.1% of 51 patients with PIRADS 4 lesions, and 73.7% of 19 patients with PIRADS 5 lesions were diagnosed with prostate cancer ($p<0.001$, Table 4). Clinically significant prostate cancer was detected in 8.2% of patients with a PIRADS score of 3, in 29.4% of patients with a PIRADS score of 4, and in 47.4% of patients with a PIRADS score of 5 ($p<0.001$, Table 4). As the PIRADS score increases, the incidence of clinically important prostate cancer increases. However, in patients with PIRADS 3 lesions, the cancer rate is unrecognizably high. This may be because the PSA values of the patients in our study group were higher than those of the other study groups, or the difficulties in PIRADS 3 and 4 discrimination in MR interpretation. Thus, clinicians should be more careful in deciding on prostate biopsy of PIRADS 3 lesions.

Prostate biopsy and predictive factors of clinically significant prostate cancer were evaluated in a study of patients with PSA levels between 4 and 10 ng/mL. After 222 prostate biopsies, 121 patients were diagnosed with prostate cancer, 92 of whom had clinically significant prostate cancer. Patient age, prostate volume, PSAD, lesion location, and PIRADS v2.1 score were correlated with prostate cancer and clinically significant prostate cancer. Among them, the PIRADS v2.1 score was found to be the best predictor of transition zone lesions with 93.1% negative predictive value, 81.8% sensitivity, and 77.1% specificity. Similar results have been obtained for peripheral zone lesions (22).

There is no definitive test for predicting prostate cancer, but diagnostic parameters can be used in combination to increase its accuracy. Sonmez et al. (23) evaluated the PSA <10 and PIRADS 3 patient groups in their study. In the study, it was found that the probability of prostate cancer increases as the number of positive risk factors such as PSA, free/total PSA ratio, familial prostate cancer history, and PIRAD3 lesion diameter increases. In our study, it was shown that the diagnostic accuracy increased with the combined use of PSAD and PIRADS scores (23).

In our study, 59 of 193 patients were diagnosed with cancer. Clinically significant prostate cancer was detected in 34 patients. Age, prostate volume, PSA, and PSAD levels were evaluated, and a clinically significant relationship was found ($p<0.05$, Table 2). In patients with BPE, the PIRADS score was better than the PSAD score ($p=0.036$, Table 6). In patients with prostate cancer, although PSAD was slightly better than the PIRADS score, no significant difference was found ($p=0.815$, Table 6). According to the data of the study, it can be said that PSAD is partially reliable in detecting cancer compared with MRI. One of the reasons for this is that the upper limit of PSA was 25 ng/mL in the study. This increases PSAD. Another reason is that patients with PIRADS 1 and 2 lesions were not included in the study when categorizing the PIRADS scores. In addition, the fact that the lesions were categorized as PIRADS 3 (intermediate risk) and PIRADS 4-5 (high risk) may also be a factor.

In a meta-analysis study by Woo et al. (24), the sensitivity of PIRADSv2-guided MRI was 89% and the specificity 73% in detecting prostate cancer in 3857 patients. In another study, prostate cancer was detected in 15% of lesions reported as PIRADS 3 and in 81% of lesions reported as PIRADS 4 or 5 (25). In the study by Kuru et al. (26), the negative predictive value of lesions reported as PIRADS 2 or 3 was 99%, and the positive predictive value of PIRADS 4 or 5 lesions was 83% (26). In our study, the sensitivity for MRI was 64.4% and the specificity was 76.1%. The positive predictive value was 54.3% and the negative predictive value was 82.9% (Table 8). The difference in the data in our study compared with similar studies may be due to the fact that conventional TRUS prostate biopsy was performed on the patients, whereas cognitive and/or MRI/TRUS fusion biopsy technique was used in the literature studies. In addition, the fact that PIRADS 1-2 lesions were also included in similar studies may be another reason.

When PIRADS v2 score and PSAD were examined together, PIRADS score ≥4 and PSAD ≥0.15, or PIRADS score 3 and PSAD ≥0.3, the highest clinically significant prostate cancer rate was found in the first biopsy (76-97%). In those with negative biopsy results, 22% of these patients were later diagnosed with cancer. In contrast, no clinically significant prostate cancer was detected in the group with a PIRADS score ≤3 and a PSAD <0.15 (27). Of the 47 patients reported as PSAD ≥0.15 and PIRADS score ≥4, 46.81% (n=22) were identified as having clinically significant prostate cancer. Of the 83 patients reported as PSAD <0.15 and PIRADS score of 3, 3.61% (n=3) were found to have clinically significant prostate cancer (Table 5). Because clinically significant prostate cancer was detected in 3 patients with PSAD <0.15 and three PIRADS lesions, more care should be taken in postponing the biopsy decision in this patient group.

Heterogeneity in patient groups and the small number of patients compared with similar studies are the main limitations of this study. Moreover, the study was not a randomized controlled study, but a retrospective one.

Conclusion

Prostate cancer is a common health problem worldwide. Therefore, there are many studies in the literature on diagnosis and treatment. In order to increase the sensitivity and specificity of PSA and to reduce the number of extra prostate biopsies, PSA derivatives and imaging methods have been developed. In this study, the role of PSAD as a PSA derivative and mp-MRI of the prostate in the diagnosis of prostate cancer was investigated. The combined use of PSAD and mp-MRI can prevent unnecessary

biopsy and subsequent complications. It can also significantly reduce the overtreatment burden.

Acknowledgements

Publication: The results of the study were not published in full or in part in form of abstracts.

Contribution: There is not any contributors who may not be listed as authors.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

Ethics

Ethics Committee Approval: The study was approved by the Sivas Cumhuriyet University Ethics Committee (decision number: 2022-03/07, date: 23.03.2022).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: H.S., A.Asd., Concept: A.A., İ.E.E., A.Asd., E.K., Design: A.Ö., A.F.V., Data Collection or Processing: A.A., A.Ö., A.F.V., Analysis or Interpretation: H.S., A.Ö., İ.E.E., A.F.V., Literature Search: H.S.,A.Asd., E.K., Writing: A.A., İ.E.E., E.K.

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