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Does the Coexistence of Prostate Cancer and Chronic Prostatitis Affect Multiparametric Magnetic Resonance Imaging? Single-Center Retrospective Study

Prostat Kanseri ve Kronik Prostatitin Birlikteliği Multiparametrik Manyetik Rezonans Görüntülemeyi Etkiler mi? Tek Merkezli Retrospektif Çalışma

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Abstract

Objective: In this study, we aimed to evaluate whether the presence of concomitant chronic prostatitis leads to a change in multiparametric magnetic resonance imaging (mpMRI) interpretation in patients with histopathological diagnosis of prostate cancer.

Methods: The data of patients who underwent transrectal ultrasound-guided prostate biopsy (TRUS-Bx) with a preliminary diagnosis of prostate cancer were retrospectively analyzed. Patients were divided into two groups according to TRUS-Bx results: those with prostate cancer and chronic prostatitis (Group 1) and those with prostate cancer only (Group 2).

Results: According to TRUS-Bx results, there were 97 patients in the group with prostate cancer + chronic prostatitis (Group 1) and 91 patients in the group with prostate cancer alone (Group 2). There was no significant difference between the two groups in terms of TRUS-Bx Gleason score and mpMRI findings [prostate imaging reporting and data system (PI-RADS) score, extraprostatic extension, and seminal vesicle invasion]. When TRUS-Bx Gleason scores were compared according to PI-RADS scores, similar results were observed and no significant difference was found between both groups.

Conclusion: The coexistence of prostate cancer and chronic prostatitis does not affect mpMRI findings. In addition to TRUS-Bx results, prospective studies with large patient series validated against radical prostatectomy specimens are needed to confirm the accuracy of the findings.

Keywords: Prostate cancer, chronic prostatitis, multiparametric magnetic resonance imaging

Öz

Amaç: Bu çalışmada, prostat kanseri histopatolojik tanısı almış hastalarda eşlik eden kronik prostatitin multiparametrik manyetik rezonans görüntüleme (mpMRI) yorumlamasında değişikliğe yol açıp açmadığını değerlendirmeyi amaçladık.

Yöntem: Prostat kanseri ön tanısıyla transrektal ultrasonografi rehberliğinde prostat biyopsisi (TRUS-Bx) yapılan hastaların verileri retrospektif olarak incelendi. Hastalar TRUS-Bx sonuçlarına göre prostat kanseri + kronik prostatit (Grup 1) ve sadece prostat kanseri (Grup 2) olmak üzere iki gruba ayrıldı.

Bulgular: TRUS-Bx sonuçlarına göre prostat kanseri + kronik prostatit (Grup 1) grubunda 97 hasta, sadece prostat kanseri (Grup 2) grubunda 91 hasta vardı. İki grup arasında TRUS-Bx Gleason skoru ve mpMRI bulguları [prostat görüntüleme raporlama ve veri sistemi (PI-RADS) skoru, ekstraprostatik yayılım

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Öz

ve seminal vezikül invazyonu] açısından anlamlı fark bulunmadı. TRUS-Bx Gleason skorları PI-RADS skorlarına göre karşılaştırıldığında, benzer sonuçlar gözlendi ve her iki grup arasında anlamlı bir fark bulunmadı.

Sonuç: Prostat kanseri ve kronik prostatitin birlikteliği mpMRI bulgularını etkilememektedir. TRUS-Bx sonuçlarına ek olarak, radikal prostatektomi örnekleriyle doğrulanmış geniş hasta serileri içeren prospektif çalışmalara ihtiyaç vardır.

Anahtar kelimeler: Prostat kanseri, kronik prostatit, multiparametrik manyetik rezonans görüntüleme

Introduction

Prostate cancer is the second most common cancer in men and the fifth most common cause of cancer death in the world[1]. Multiparametric prostate magnetic resonance imaging (mpMRI) has an important role in the diagnosis and local staging of clinically significant prostate cancer[2]. To standardize mpMRI interpretation, the prostate imaging reporting and data system (PI-RADS) scoring system was published by the European Society of Urogenital Radiology (ESUR) in 2012 and subsequently updated to PI-RADSv2.1 in 2019[3,4].

Although mpMRI has advantages in detecting clinically significant prostate cancer, some benign lesions can also mimic prostate cancer. Benign conditions such as some normal anatomical structures, post-biopsy haemorrhages, necrosis, calcification, prostatitis may be interpreted as prostate cancer, and may cause confusion during interpretation[5-9]. In addition, the effect of the coexistence of prostate cancer and chronic prostatitis on mpMRI interpretation is not known. In this study, we aimed to evaluate whether the presence of concomitant chronic prostatitis leads to a change in mpMRI interpretation in patients with a histopathological diagnosis of prostate cancer.

Materials and Methods

Patient Selection

Atatürk University Non-interventional Clinical Research Ethics Committee approval was obtained (decision no: 62, date: 27.12.2024). Then, the data of patients who underwent transrectal ultrasound-guided prostate biopsy (TRUS-Bx) with a preliminary diagnosis of prostate cancer at Erzurum City Hospital between June 2020 and December 2024 were retrospectively analyzed. Individuals with a history of previous TRUS-Bx, those who had not undergone mpMRI before TRUS-Bx, those who had more than 6 months between TRUS-Bx and mpMRI, and those with missing data were excluded from the study. Patients were divided into two groups according to TRUS-Bx results as patients with prostate cancer + chronic prostatitis (Group 1) and patients with prostate cancer only (Group 2). The parameters analyzed were age, prostate-specific antigen (PSA), prostate size on mpMRI, PSA density, mpMRI findings (PI-RADS score, extraprostatic extension and seminal vesical invasion) and TRUS-Bx pathology results.

TRUS-Bx Protocol

All patients administered an enema at home for intestinal cleansing on the morning of the procedure. Sterile urine culture was obtained for all patients before TRUS-Bx and prophylactic 1 g ceftriaxone was administered. In the left lateral decubitus position, rectal preparation was performed with povidone-iodine, and 4 mL of lidocaine was used bilaterally for peri-prostatic nerve block. Systematic biopsies of 12 cores were obtained from all patients. All mpMRIs performed in our clinic are interpreted by a single radiologist (D.Ö.K.) before TRUS-Bx. In patients with PI-RADS 3 or higher lesions on mpMRI, 3 cores of cognitive fusion biopsy are performed in addition to systematic biopsy.

mpMRI Protocol

All mpMRIs were performed on a 1.5 Tesla MR device (General Electric Signa Explorer, GE Medical Systems, USA) using a pelvic coil. The bladder was emptied in all patients before the procedure. Evaluations were performed with T2-weighted sagittal-axial-coronal, T1-weighted axial, diffusion-weighted, and T1-weighted fat-suppressed dynamic contrast-enhanced images.

In T2-weighted images, time to echo (TE) is 124 msec, time to repeat (TR) is 5095 msec, and slice thickness is 3.5 mm. In diffusion-weighted images, TE is 73 msec, TR is 2000 msec, slice thickness is 3.5 mm, and b-values are 50, 800, 1500. In dynamic contrast-enhanced T1-weighted images, TE is 1.4 msec, TR is 3 msec, and slice thickness is 4.4 mm. For dynamic contrast-enhanced images, 0.2 mL/kg contrast medium (gadoteric acid) was administered intravenously.

Statistical Analysis

All statistical analyses were performed using SPSS, version 22 (IBM, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation and categorical variables as number (percentage). Normal distribution of continuous variables was evaluated by the Kolmogorov-Smirnov test. In the comparison of continuous variables the independent t-test was used for those with normal distribution, and the Mann-Whitney U test was used for those without normal distribution. Pearson chi-square or Fisher's exact tests were used to compare categorical variables. A p-value less than 0.05 was considered significant.

Results

According to TRUS-Bx results, there were 97 patients in the group with prostate cancer + chronic prostatitis (Group 1) and 91 patients in the group with prostate cancer alone (Group 2). The mean age of the patients was 63.8±6.9 years, the mean PSA value was 9.9±6.3 ng/mL, the mean prostate volume was 51.7±18.6 mL, and the mean PSA density was 0.21±0.16. Patient characteristics, mpMRI findings and TRUS-Bx results are shown in Table 1.

There was no significant difference between the two groups in terms of age, prostate volume, and PSA density, but PSA value was significantly higher in Group 1 (p=0.028). There was no significant difference between the two groups in terms of TRUS-Bx Gleason score and number of positive cores. Again, no significant difference was observed between the two groups in terms of PI-RADS score, extraprostatic extension, and seminal vesicle invasion determined by mpMRI (Table 2). When TRUS-Bx Gleason scores were compared according to PI-RADS scores, no significant difference were found between the groups (Table 3).

Discussion

T2-weighted images reveal the anatomical features of prostate cancer. Prostate cancer presents in a focal and lower-density form against a background of high-density gland tissue[3,9]. However, it has been reported that the use of anatomical T2-weighted images alone may cause false positive findings[9]. So, in addition to T2-weighted imaging, diffusion-weighted imaging, and dynamic contrast-enhanced imaging have been added, and prostate imaging with a multiparametric approach has been developed[10,11]. Diffusion-weighted imaging reflects the movement of fluid in tissues, which is related to properties such as cell density, intercellular space and membrane permeability. Prostate

Table 1. Patient characteristics, mpMRI findings and TRUS-Bx results

Variables	n=188
Age (years), mean ± SD	63.8±6.9
Prostate-specific antigen (ng/mL), median (min-max)	8 (3.4-37)
Prostate volume on mpMRI (mL), median (min-max)	46 (26-133)
PSA density, median (min-max)	0.16 (0.05-1.06)
Biopsy Gleason score (%)	
3+3	136 (72.3%)
3+4	31 (16.5%)
4+3	13 (6.9%)
8-10	8 (4.3%)
Number of positive cores, median (min-max)	3 (1-11)
mpMRI, PI-RADS score (%)	
≤2	33 (17.6%)
3	35 (18.6%)
4	112 (59.6%)
5	8 (4.3%)
Presence of EPE on mpMRI (%)	45 (23.9%)
Presence of SVI on mpMRI (%)	16 (8.5%)

SD: Standard deviation, mpMRI: Multiparametric magnetic resonance imaging, EPE: Extraprostatic extension, SVI: Seminal vesicle invasion, PSA: Prostate-specific antigen, PI-RADS: Prostate imaging reporting and data system, TRUS-Bx: transrectal ultrasound-guided prostate biopsy

Table 2. Comparison of patient characteristics, mpMRI findings and TRUS-Bx results between groups

Variables [mean ± SD/n (%)]	Bx result		
	Group 1 (n=97)	Group 2 (n=91)	p-value
Age (years)	63.4±5.8	64.1±6	0.403
Prostate-specific antigen (ng/mL)	10.8±6.9	9±5.4	0.028
Prostate volume on mpMRI (mL)	51.9±17.9	51.4±19.4	0.724
PSA density	0.24±0.19	0.19±0.12	0.125
Biopsy Gleason score			0.115
3+3	65 (67%)	71 (78%)	
3+4	19 (19.6%)	12 (13.2%)	
4+3	10 (10.3%)	3 (3.3%)	
>8	3 (3.1%)	5 (5.5%)	
Number of positive cores	3.8±2.4	3.7+2.2	0.962
mpMRI, PI-RADS score (%)			0.886
2	18 (18.6%)	15 (16.5%)	
3	17 (17.5%)	18 (19.8%)	
4	57 (58.8%)	55 (60.4%)	
5	5 (5.2%)	3 (3.3%)	
EPE on mpMRI (%)	23 (23.7%)	22 (24.2%)	0.941
SVI on mpMRI (%)	9 (9.3%)	7 (7.7%)	0.697

SD: Standard deviation, mpMRI: Multiparametric magnetic resonance imaging, EPE: Extraprostatic extension, SVI: Seminal vesicle invasion, PSA: Prostate-specific antigen, PI-RADS: Prostate imaging reporting and data system, TRUS-Bx: transrectal ultrasound-guided prostate biopsy

Table 3. Comparison of TRUS-Bx Gleason scores according to PI-RADS scores between groups

Variables [n (%)]	Bx result		
	Group 1	Group 2	p-value
PI-RADS*			
2			0.530
3+3	17 (94.4%)	13 (86.7%)	
3+4	1 (5.6%)	1 (6.7%)	
4+3	0	1 (6.7%)	
≥8	0	0	
3			0.982
3+3	13 (76.5%)	13 (72.2%)	
3+4	2 (11.8%)	3 (16.7%)	
4+3	1 (5.9%)	1 (5.6%)	
≥8	1 (5.9%)	1 (5.6%)	
4			0.161
3+3	34 (59.6%)	43 (78.2%)	
3+4	15 (26.3%)	8 (14.5%)	
4+3	6 (10.5%)	2 (3.6%)	
≥8	2 (3.5%)	2 (3.6%)	

*PI-RADS 5 was not included in the analysis due to an insufficient number of cases.

cancer appears bright on diffusion-weighted imaging and dark on apparent diffusion coefficient (ADC) maps, indicating diffusion restriction[12]. Dynamic contrast-enhanced imaging includes T1-weighted axial images obtained after intravenous contrast material is administered. In prostate cancer, early rapid contrast enhancement followed by washout or plateau is observed[9,13].

In mpMRI of prostatitis, low T2 signal intensity and mild or moderate diffusion restriction can be expected. Diffusion restriction is expected to be less than it is in prostate cancer. Dynamic contrast-enhanced imaging shows early and increased contrast uptake similar to prostate cancer[9,14,15]. Chronic prostatitis and prostate cancer can often be confused because they have similar mpMRI findings. The distinction between prostate cancer and chronic prostatitis has not been clearly demonstrated on mpMRI[5], and clarifying this distinction may lead to a significant reduction in transrectal ultrasound-guided biopsy rates.

Quantitative parameters of mpMRI were investigated to distinguish between prostate cancer and chronic prostatitis. Uysal et al.[5] determined that quantitative ADC values, quantitative pharmacokinetic parameters (Ktrans, kep, Ve, and Vp), and time to peak were significant in the differentiation of prostate cancer and chronic prostatitis, and found that the logistic regression model including all parameters had a diagnostic accuracy of 92.7%. Peker et al.[7] found that ADC had the highest sensitivity and specificity compared to other criteria. However, the combination of normalized T2-signal intensity, ADC values, and washing percentage provided the highest sensitivity (77.7%) and specificity (85.7%) among all combinations. Although quantitative measures of mpMRI, especially ADC, are promising, the role of the PI-RADS scoring system in differentiating prostate cancer from chronic prostatitis is still limited. Further studies may lead to the inclusion of quantitative measurements in new versions of PI-RADS.

In histopathological preparations obtained by TRUS-Bx, the coexistence of prostate cancer and chronic prostatitis can be seen frequently; and it is not known whether this affects mpMRI. Although there are studies in the literature investigating the effect of chronic prostatitis on mpMRI, our study is unique in that it investigates whether chronic prostatitis accompanying prostate cancer affects mpMRI interpretation, and whether there is a discordance between the PI-RADS score and the TRUS-Bx Gleason score. According to our study, there was no significant difference in mpMRI results (PI-RADS score, extraprostatic extension and seminal vesicle invasion) and Gleason scores between patients with only prostate cancer and patients with prostate cancer + chronic prostatitis. In addition, when TRUS-Bx Gleason scores were compared according to PI-RADS scores, no significant difference was observed in both groups.

Study Limitations

The strength of our study is that it is the first to examine whether chronic prostatitis accompanying prostate cancer has an effect on mpMRI interpretation. On the other hand, the retrospective nature of the study and its lack of confirmation with radical prostatectomy material, but only evaluation with TRUS-Bx, are limitations. Another limitation is the absence of a third group of patients with mpMRI findings who did not have prostate cancer but had only chronic prostatitis on TRUS-Bx. Additionally, the 1.5 T MRI device can be considered as one of the limitations.

Conclusion

The coexistence of prostate cancer and chronic prostatitis does not affect mpMRI findings. In future studies, various differences can be identified with new versions of PI-RADS. In addition to TRUS-Bx results, prospective studies with large patient series validated with radical prostatectomy specimens are needed.

Ethics

Ethics Committee Approval: Atatürk University Non-interventional Clinical Research Ethics Committee approval was obtained (decision no: 62, date: 27.12.2024).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Concept: E.Ş., D.Ö.K., Design: E.Ş., D.Ö.K., Data Collection or Processing: E.Ş., Analysis or Interpretation: E.Ş., D.Ö.K., Literature Search: E.Ş., D.Ö.K., Writing: E.Ş., D.Ö.K.

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