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Concordance of Gleason Score and Prognostic Grade Group Between Transrectal Ultrasound-Guided Biopsy and Radical Prostatectomy

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ABSTRACT

Objective: Grading discordance between transrectal ultrasound (TRUS)-guided biopsy and radical prostatectomy (RP) specimens represents a clinically significant challenge in prostate cancer management. This study aimed to evaluate the concordance of Gleason score (GS) and prognostic grade group (GG) between TRUS-guided biopsy and RP specimens, and to identify histopathological parameters associated with grading discordance.

Materials and Methods: This retrospective study included 88 patients who underwent TRUS-guided biopsy followed by RP between 2023 and 2026. All biopsy and RP specimens were re-evaluated by two pathologists according to 2019 ISUP consensus criteria. Grading changes were classified as concordant, upgraded, or downgraded. Cohen's kappa coefficient and Spearman correlation were used to assess agreement and correlation. Clinicopathological parameters associated with GG change were analyzed using Chi-square and Fisher's exact tests.

Results: The mean patient age was 66.41±6.5 years. GS and GG concordance was 64.8% (n=57), upgrading was observed in 29.5% (n=26), and downgrading in 5.7% (n=5). Moderate agreement was found for both GS (κ=0.458) and GG (κ=0.456), with significant positive correlations (Spearman rho=0.680 and 0.703, respectively; p<0.001). Biopsy tumor volume (p=0.005), perineural invasion (p=0.044), and pattern 4 ratio (p=0.028) were significantly associated with GG change. Among RP parameters, extraprostatic extension (p=0.002), perineural invasion (p=0.006), surgical margin status (p=0.021), and tumor volume (p=0.018) were significantly related to grading discordance. Age and pre-biopsy PSA level showed no significant association with GG change.

Conclusion: TRUS-guided biopsy demonstrated moderate concordance with RP specimens. Biopsy-derived parameters including tumor volume, perineural invasion, and pattern 4 ratios provide valuable predictive information for grading discordance. These findings highlight the importance of systematically integrating routine histopathological data into clinical decision-making to optimize patient management.

Keywords: Concordance, Downgrading, Gleason score, Prognostic grade group, Prostate cancer, Radical prostatectomy, Transrectal ultrasound-guided biopsy, Upgrading

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INTRODUCTION

Prostate cancer remains one of the most frequently diagnosed malignancies in men and ranks second among cancer-related causes of death.[1] The disease represents a heterogeneous group of tumors exhibiting a broad spectrum of biological behavior, which renders risk classification both necessary and challenging.[1] The Gleason score (GS) and the 2019 International Society of Urological Pathology (ISUP) prognostic grade group (GG) system (GG 1–5) are among the primary tools used in prostate cancer management for determining treatment strategy, selecting between active surveillance and definitive treatment, and conducting prognostic assessment.[2,3]

Prostate biopsy remains the standard procedure for obtaining diagnosis and performing initial histopathological grading.[4] Transrectal ultrasound (TRUS)-guided biopsy samples only a limited portion of the prostate gland. This may introduce significant sampling error and lead to grading discordance between biopsy and radical prostatectomy (RP) specimens.[1] In the literature, GS discordance between biopsy and RP specimens has been reported in 28–76% of cases.[4] A significant proportion of patients have been found to have grade upgrading following prostatectomy.[4] When evaluated at the GG level, concordance has been reported to be approximately 54.5%, with upgrading observed in 31.1% and downgrading in 14.3% of cases.[2]

The clinical significance of this discordance is substantial. Patients undergraded at biopsy may receive insufficient treatment and face a risk of disease progression, whereas overgraded patients may be subjected to unnecessarily aggressive interventions.[5] Grade upgrading has been identified as an independent predictor of biochemical recurrence following local treatment, even after controlling for known pre-operative variables.[1] This issue carries particular clinical relevance for active surveillance candidates; patients classified as GG 1 or GG 2 at biopsy may subsequently be found to have higher GGs at prostatectomy.[6,7]

The pathogenesis of grading discordance is multifactorial. Since TRUS biopsy does not represent the entire prostate gland, there is always a possibility that tumor foci harboring higher Gleason patterns remain unsampled.[1] Differences in grading approaches between biopsy and prostatectomy specimens may also contribute to discordance. In needle biopsies, GS is typically determined based on the most prevalent and highest-grade pattern due to limited tissue sampling, whereas RP specimens allow more comprehensive evaluation – with the primary and secondary patterns of the dominant tumor focus assessed, and low-proportion high-grade tertiary patterns also reportable.[8] Tumor multifocality and intratumoral histological heterogeneity are also among the principal pathological factors that make it difficult to reflect true tumor biology through limited tissue sampling.[1] Interobserver variability in distinguishing the morphological boundary between Gleason pattern 3 and pattern 4 represents another important source of discordance; although a second pathologist opinion has been shown to improve concordance, it cannot completely eliminate the difference between biopsy and prostatectomy specimens.[4]

This study aimed to evaluate GS and GG concordance, upgrading and downgrading rates, and the histopathological parameters contributing to grading discordance in patients who underwent TRUS-guided biopsy followed by RP at our institution between 2023 and 2026. The findings were intended to provide an institutional contribution to the grading accuracy of TRUS biopsy and to shed light on pathological evaluation processes.

MATERIALS AND METHODS

Study Design and Case Selection

This study was designed retrospectively on a total of 110 patients who underwent RP at our institution's Department of Pathology between 2023 and 2026 and had matched TRUS biopsy material available. Only patients whose both TRUS biopsy and RP specimens were evaluated at our institution's Department of Pathology were included.

Exclusion criteria were defined as follows: Patients who had received neoadjuvant hormonal therapy or radiotherapy, and patients whose pathology reports were inaccessible. The RP specimen had been evaluated at an external center in 10 patients, and the TRUS biopsy material in seven patients; these cases were therefore excluded from the study. In 5 cases, glass slides and paraffin blocks were unavailable, and these patients were also excluded. As a result, the study was conducted on 88 patients whose both TRUS biopsy and RP materials were accessible from our institution's archive.

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the University of Health Sciences, Gaziosmanpasa Training and Research Hospital, Ethics Committee (Approval No: 82, Date: April 22, 2026).

Histopathological Evaluation

All TRUS biopsy and RP specimens were retrospectively re-evaluated by two pathologists from the archive of our institution's Department of Pathology. TRUS biopsies were assessed using a 12-core scheme.

GS and GG were recorded separately for both materials. Prognostic grade grouping was performed in accordance with

the ISUP consensus criteria.[3] Cases in which disagreement existed between pathologists were resolved by reaching consensus.

The following histopathological parameters were recorded for both materials: GS, GG, primary and secondary Gleason pattern, tumor volume (%), Gleason pattern 4 ratio (in cases containing pattern 4, expressed as a percentage), and the presence of perineural invasion. Tumor volume was assessed as the percentage of total tumor extent in the relevant material; the pattern 4 ratio was additionally recorded as the percentage of pattern 4 within the tumor in cases containing a Gleason pattern 4 component. The presence of tertiary pattern 5 was also queried separately in both materials.

Additional parameters specific to RP specimens were also evaluated: surgical margin status (positive/negative), extraprostatic extension (EPE), and lymphovascular invasion. All prostatectomy specimens were submitted entirely for histopathological examination in serial sections in accordance with ISUP recommendations.[9]

Concordance and Correlation Analysis

GS and GG between TRUS biopsy and RP specimens were compared, and cases were classified as follows: unchanged (concordant), upgraded, or downgraded. Cohen's kappa coefficient was used for quantitative measurement of grading concordance; κ values were interpreted as: 0–0.20 poor agreement, 0.21–0.40 fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 good agreement, and 0.81–1.00 excellent agreement. Spearman correlation analysis was applied to evaluate the ordinal relationship between biopsy and prostatectomy materials.

Statistical Analysis

Statistical analysis was performed using IBM Statistical Package for the Social Sciences Statistics 25.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Shapiro-Wilk test in conjunction with histogram, Q-Q plot, and boxplot graphs.

In descriptive statistics, continuous variables were presented as mean±standard deviation or median (interquartile range [IQR]) according to their distribution characteristics, and categorical variables were presented as frequency and percentage (*n* [%]). Continuous variables with normal distribution were analyzed using the independent samples t-test, and those without normal distribution were analyzed using the Mann–Whitney U test. Categorical variables were compared using the Chi-square test; Fisher's exact test or, in multi-cell tables, the Fisher-Freeman-Halton exact test was applied when expected cell counts were insufficient. A $p<0.05$ was considered statistically significant in all analyses, and all tests were two-tailed.

RESULTS

A total of 88 patients who underwent RP were included in the study. The demographic and clinicopathological characteristics of the patients are summarized in Table 1. The mean age of the patients was 66.41±6.5 years, with an age range of 50–82 years. When evaluated by age group, the majority of patients were in the 55–75 age range (85.2%, *n*=75). The proportion of patients under 55 years was 4.5% (*n*=4), and the proportion of patients over 75 years was 10.2% (*n*=9) (Table 1).

Table 1. Demographic and clinicopathologic characteristics

Variable	Value	Note
Age, years	66.41±6.5	*n*=88
Age, median (IQR)	66.5 (61.8–71.0)	
Age group		*n*=88
<55	4 (4.5)	
55–75	75 (85.2)	
>75	9 (10.2)	
Pre-biopsy PSA		*n*=77
<4	13 (16.9)	
4–10	46 (59.7)	
>10	18 (23.4)	
Post-prostatectomy PSA		*n*=88
<1	88 (100.0)	
Biopsy Gleason score		*n*=88
3+3=6	55 (62.5)	
3+4=7	17 (19.3)	
4+3=7	9 (10.2)	
4+4=8	6 (6.8)	
4+5=9	1 (1.1)	
Biopsy GG		*n*=88
GG 1	55 (62.5)	
GG 2	17 (19.3)	
GG 3	9 (10.2)	
GG 4	6 (6.8)	
GG 5	1 (1.1)	
Biopsy tumor volume		*n*=88
1–5%	44 (50.0)	
6–10%	14 (15.9)	
11–20%	12 (13.6)	
21–30%	11 (12.5)	

Table 1. Continue

Variable	Value	Note
Biopsy tumor volume		*n*=88
31–40%	6 (6.8)	
41–50%	1 (1.1)	
Biopsy perineural invasion		*n*=88
Present	16 (18.2)	
Absent	72 (81.8)	
Biopsy pattern 4 ratio		*n*=18
6–10%	2 (11.1)	
11–20%	5 (27.8)	
21–30%	4 (22.2)	
31–40%	2 (11.1)	
41–50%	1 (5.6)	
51–60%	1 (5.6)	
61–70%	1 (5.6)	
71–80%	2 (11.1)	
Biopsy tertiary pattern		*n*=88
Present	2 (2.3)	
Absent	86 (97.7)	
Prostatectomy Gleason score		*n*=88
3+3=6	38 (43.2)	
3+4=7	27 (30.7)	
4+3=7	14 (15.9)	
4+4=8	6 (6.8)	
4+5=9	3 (3.4)	
Prostatectomy GG		*n*=88
GG 1	38 (43.2)	
GG 2	29 (33.0)	
GG 3	12 (13.6)	
GG 4	6 (6.8)	
GG 5	3 (3.4)	
Prostatectomy tumor volume		*n*=88
1–5%	30 (34.1)	
6–10%	12 (13.6)	
11–20%	23 (26.1)	
21–30%	7 (8.0)	
31–40%	8 (9.1)	
41–50%	3 (3.4)	
51–60%	1 (1.1)	
61–70%	1 (1.1)	

Table 1. Continue

Variable	Value	Note
Prostatectomy tumor volume		*n*=88
71–80%	2 (2.3)	
81–90%	0 (0.0)	
>90%	1 (1.1)	
Surgical margin		*n*=88
Positive	31 (35.2)	
Negative	57 (64.8)	
Prostatectomy perineural invasion		*n*=88
Present	54 (61.4)	
Absent	34 (38.6)	
Extraprostatic extension		*n*=88
Present	21 (23.9)	
Absent	67 (76.1)	
Prostatectomy pattern 4 ratio		*n*=31
1–5%	2 (6.5)	
6–10%	8 (25.8)	
11–20%	7 (22.6)	
21–30%	6 (19.4)	
31–40%	2 (6.5)	
61–70%	2 (6.5)	
71–80%	2 (6.5)	
81–90%	1 (3.2)	
>90%	1 (3.2)	
Prostatectomy tertiary pattern		*n*=88
Present	4 (4.5)	
Absent	84 (95.5)	last

Values are presented as mean±SD, median [IQR], or *n* (%). PSA: Prostate-specific antigen, GG: Grade group, PNI: Perineural invasion

When pre-biopsy PSA levels were evaluated, PSA values were below 4 ng/mL in 16.9% (*n*=13), between 4–10 ng/mL in 59.7% (*n*=46), and above 10 ng/mL in 23.4% (*n*=18) of patients. Post-prostatectomy PSA levels were below 1 ng/mL in all cases (100%, *n*=88).

When the GS distribution in TRUS biopsy materials was examined, the most frequently observed score was 3+3=6 (62.5%, *n*=55), followed by 3+4=7 (19.3%, *n*=17), 4+3=7 (10.2%, *n*=9), and 4+4=8 (6.8%, *n*=6); a GS of 4+5=9 was detected in one case (1.1%). With regard to TRUS biopsy GG, 62.5% (*n*=55) of patients were classified as GG 1, 19.3% (*n*=17) as GG 2, 10.2% (*n*=9) as GG 3, 6.8% (*n*=6) as GG 4, and 1.1% (*n*=1) as GG 5.

Tumor volume in TRUS biopsy materials was most frequently observed in the 1–5% range, and this group constituted 50.0% (*n*=44) of all cases. This was followed by patients with a tumor volume of 6–10% (15.9%, *n*=14), 11–20% (13.6%, *n*=12), and 21–30% (12.5%, *n*=11). Perineural invasion was detected in 18.2% (*n*=16) of TRUS biopsy materials, while 81.8% (*n*=72) of cases showed no perineural invasion. Tertiary pattern was present in only 2.3% (*n*=2) of TRUS biopsy materials.

When the GS distribution in RP materials was examined, the most frequently detected score was 3+3=6 (43.2%, *n*=38), followed by 3+4=7 (30.7%, *n*=27), 4+3=7 (15.9%, *n*=14), 4+4=8 (6.8%, n=6), and 4+5=9 (3.4%, *n*=3). The GG distribution in RP materials showed that 43.2% (*n*=38) of patients were classified as GG 1, 33.0% (*n*=29) as GG 2, 13.6% (*n*=12) as GG 3, 6.8% (*n*=6) as GG 4, and 3.4% (*n*=3) as GG 5 (Fig. 1).

When tumor volume in RP materials was evaluated, tumor volume was in the 1–5% range in 34.1% (*n*=30), 6–10% in 13.6% (*n*=12), 11–20% in 26.1% (*n*=23), and 21–30% in 8.0% (*n*=7) of patients. Tumor at the surgical margin was observed in 35.2% (*n*=31) of patients, while 64.8% (*n*=57) had negative surgical margins. Perineural invasion was detected in 61.4% (*n*=54) and EPE in 23.9% (*n*=21) of RP materials. Tertiary pattern was present in 4.5% (*n*=4) of cases.

When GS change between TRUS biopsy and RP materials was evaluated, GS remained the same in 64.8% (*n*=57), a higher GS was detected in the RP material in 29.5% (*n*=26) (Fig 2a and b), and a lower GS was observed in 5.7% (*n*=5). Similarly, regarding GG, concordance was noted in 64.8% (*n*=57), upgrading in 29.5% (*n*=26), and downgrading in 5.7% (*n*=5) of cases (Table 2).

When agreement between TRUS biopsy and RP specimens was evaluated using Cohen's kappa coefficient for GS, moderate agreement was found (κ=0.458). A statistically significant positive correlation was detected in the correlation analysis between GS values (Spearman rho=0.680, p<0.001). Moderate agreement was also observed between biopsy and prostatectomy materials for GG (κ=0.456). The correlation between GG values was positive and statistically significant (Spearman rho=0.703, p<0.001) (Table 3).

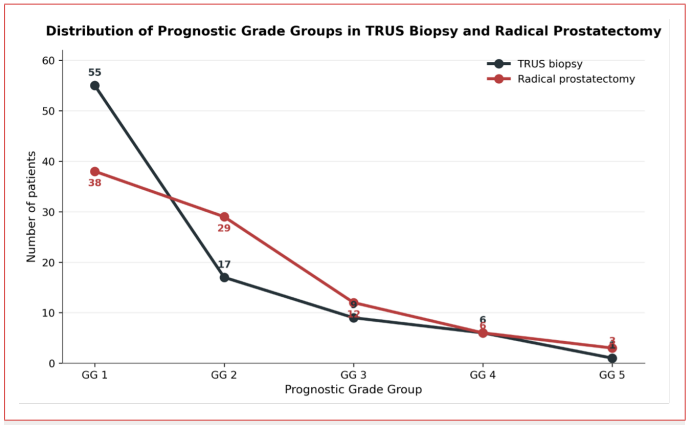

Figure 1. Distribution of prognostic grade groups in transrectal ultrasound biopsy and radical prostatectomy.

When GS change was evaluated by age group, the upgrading rate was 25.0% (*n*=1), and the concordance rate was 75.0% (*n*=3) among patients under 55 years of age. In the 55–75 age group, the upgrading rate was 32.0% (*n*=24), the concordance rate was 62.7% (*n*=47), and the downgrading rate was 5.3% (*n*=4). In patients over 75 years of age, upgrading was observed in 11.1% (*n*=1), concordance in 77.8% (*n*=7), and downgrading in 11.1% (*n*=1). No statistically significant association was found between age groups and GS change (p=0.685). The same distribution was observed for GG change, and no significant association was found between age groups and GG change (p=0.685).

Table 2. Gleason score on TRUS biopsy and radical prostatectomy with score change

TRUS biopsy	Radical prostatectomy, *n* (% of TRUS biopsy group)						Change in score, *n* (% of TRUS biopsy group)		
	3+3=6	3+4=7	4+3=7	4+4=8	4+5=9	Total	Upgraded	Same	Downgraded
3+3=6	36 (65.5)	13 (23.6)	6 (10.9)	0	0	55	19 (34.5)	36 (65.5)	0
3+4=7	2 (11.8)	13 (76.5)	1 (5.9)	1 (5.9)	0	17	2 (11.8)	13 (76.5)	2 (11.8)
4+3=7	0	0	5 (55.6)	3 (33.3)	1 (11.1)	9	4 (44.4)	5 (55.6)	0
4+4=8	0	1 (16.7)	2 (33.3)	2 (33.3)	1 (16.7)	6	1 (16.7)	2 (33.3)	3 (50.0)
4+5=9	0	0	0	0	1 (100.0)	1	0	1 (100.0)	0
Total	38	27	14	6	3	88	26 (29.5)	57 (64.8)	5 (5.7)

Rows represent TRUS biopsy Gleason score; columns represent radical prostatectomy Gleason score. Cell values are *n* (% of TRUS biopsy group)

Table 3. Agreement statistics between TRUS biopsy and radical prostatectomy

Comparison	Valid *n*	Cohen kappa	Spearman rho	p
Gleason score	88	0.458	0.680	<0.001
Prognostic grade group	88	0.456	0.703	<0.001

TRUS: Transrectal ultrasound

Association of Clınıcopathological Parameters wıth Prognostic GG Change

GG change was compared with age, PSA level, biopsy findings, and histopathological parameters of the prostatectomy material. No significant association was found between age and GG change (p=0.685). Similarly, no statistically significant association was detected between pre-biopsy PSA value and GG change (p=0.373).

In contrast, statistically significant associations were found between TRUS biopsy GS and TRUS biopsy GG and post-prostatectomy GG change (p<0.001 for both). Biopsy tumor volume was also significantly associated with GG change (p=0.005). In addition, the presence of perineural invasion in TRUS biopsy material (p=0.044) and biopsy pattern 4 ratio (p=0.028) were significantly associated with GG change (p<0.001).

When parameters from the RP material were evaluated, a significant association was found between prostatectomy GS and prostatectomy GG and GG change (p<0.001). Tumor volume (p=0.018), surgical margin status (p=0.021), the presence of perineural invasion (p=0.006), and EPE (p=0.002) in the prostatectomy material were also significantly associated with GG change. A borderline near-significant association was observed between pattern 4 ratio in the prostatectomy material and GG change, but it did not reach statistical significance (p=0.061). No significant association was found between tertiary pattern presence in the prostatectomy material and GG change (p=0.232) (Table 4).

In this study, approximately two-thirds concordance was observed between TRUS biopsy and RP materials in terms of both GS and GG. However, in approximately one-third of cases, higher GS and GG were detected in the RP material. This finding demonstrates that while TRUS biopsy is an important diagnostic tool in prostate cancer, it may not always fully reflect tumor heterogeneity.

DISCUSSION

Grading discordance between TRUS biopsy and RP in the histopathological assessment of prostate cancer is a long-

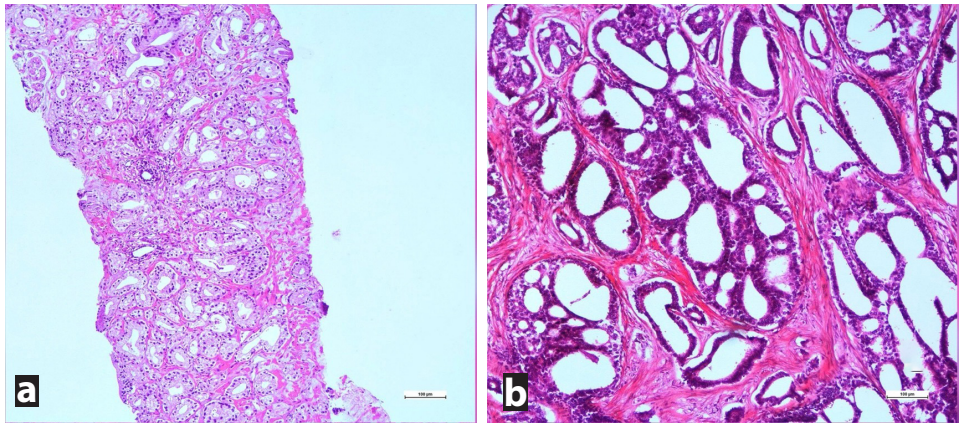

Figure 2. (a) Prostatic acinar adenocarcinoma, Gleason score 3+3=6 (Grade Group 1). The neoplastic glands are small to medium-sized, well-formed, and infiltrate between benign glands without fusion or cribriform architecture. Hematoxylin-Eosin stain, ×100. **(b)** Cribriform glands consistent with Gleason pattern 4, representing a Gleason score of 3+4=7 (Grade group 2; PAA: Prostatic acinar adenocarcinoma). The cribriform structures show irregular lumina with intraluminal bridging. Hematoxylin-Eosin stain, ×100.

Table 4. Clinicopathologic comparisons according to GG change

Variable	Upgraded *n* (%)	Same *n* (%)	Downgraded *n* (%)	p
Age group				0.685
<55	1 (25.0)	3 (75.0)	0 (0.0)	
55–75	24 (32.0)	47 (62.7)	4 (5.3)	
>75	1 (11.1)	7 (77.8)	1 (11.1)	
Pre-biopsy PSA				0.373
<4	2 (15.4)	9 (69.2)	2 (15.4)	
4–10	13 (28.3)	32 (69.6)	1 (2.2)	
>10	4 (22.2)	12 (66.7)	2 (11.1)	
Biopsy Gleason score				<0.001
3+3=6	19 (34.5)	36 (65.5)	0 (0.0)	
3+4=7	2 (11.8)	13 (76.5)	2 (11.8)	
4+3=7	4 (44.4)	5 (55.6)	0 (0.0)	
4+4=8	1 (16.7)	2 (33.3)	3 (50.0)	
4+5=9	0 (0.0)	1 (100.0)	0 (0.0)	
Biopsy GC				<0.001
GG 1	19 (34.5)	36 (65.5)	0 (0.0)	
GG 2	2 (11.8)	13 (76.5)	2 (11.8)	
GG 3	4 (44.4)	5 (55.6)	0 (0.0)	
GG 4	1 (16.7)	2 (33.3)	3 (50.0)	
GG 5	0 (0.0)	1 (100.0)	0 (0.0)	
Biopsy tumor volume				0.005
1–5%	11 (25.0)	32 (72.7)	1 (2.3)	
6–10%	5 (35.7)	8 (57.1)	1 (7.1)	
11–20%	2 (16.7)	8 (66.7)	2 (16.7)	
21–30%	5 (45.5)	6 (54.5)	0 (0.0)	
31–40%	3 (50.0)	3 (50.0)	0 (0.0)	
41–50%	0 (0.0)	0 (0.0)	1 (100.0)	
Biopsy PNI				0.044
Present	4 (25.0)	9 (56.2)	3 (18.8)	
Absent	22 (30.6)	48 (66.7)	2 (2.8)	
Biopsy pattern 4 ratio				0.028
6–10%	0 (0.0)	2 (100.0)	0 (0.0)	
11–20%	0 (0.0)	5 (100.0)	0 (0.0)	
21–30%	1 (25.0)	3 (75.0)	0 (0.0)	
31–40%	1 (50.0)	1 (50.0)	0 (0.0)	
41–50%	0 (0.0)	1 (100.0)	0 (0.0)	
51–60%	1 (100.0)	0 (0.0)	0 (0.0)	
61–70%	0 (0.0)	0 (0.0)	1 (100.0)	
71–80%	1 (50.0)	1 (50.0)	0 (0.0)	

Table 4. Continue

Variable	Upgraded *n* (%)	Same *n* (%)	Downgraded *n* (%)	p
Biopsy tertiary pattern				0.573
Present	0 (0.0)	2 (100.0)	0 (0.0)	
Absent	26 (30.2)	55 (64.0)	5 (5.8)	
RP Gleason score				<0.001
3+3=6	0 (0.0)	36 (94.7)	2 (5.3)	
3+4=7	13 (48.1)	13 (48.1)	1 (3.7)	
4+3=7	7 (50.0)	5 (35.7)	2 (14.3)	
4+4=8	4 (66.7)	2 (33.3)	0 (0.0)	
4+5=9	2 (66.7)	1 (33.3)	0 (0.0)	
RP GG				<0.001
GG 1	0 (0.0)	36 (94.7)	2 (5.3)	
GG 2	15 (51.7)	13 (44.8)	1 (3.4)	
GG 3	5 (41.7)	5 (41.7)	2 (16.7)	
GG 4	4 (66.7)	2 (33.3)	0 (0.0)	
GG 5	2 (66.7)	1 (33.3)	0 (0.0)	
RP tumor volume				0.018
1–5%	4 (13.3)	25 (83.3)	1 (3.3)	
6–10%	3 (25.0)	9 (75.0)	0 (0.0)	
11–20%	11 (47.8)	11 (47.8)	1 (4.3)	
21–30%	3 (42.9)	3 (42.9)	1 (14.3)	
31–40%	4 (50.0)	3 (37.5)	1 (12.5)	
41–50%	1 (33.3)	2 (66.7)	0 (0.0)	
51–60%	0 (0.0)	1 (100.0)	0 (0.0)	
61–70%	0 (0.0)	1 (100.0)	0 (0.0)	
71–80%	0 (0.0)	2 (100.0)	0 (0.0)	
>90%	0 (0.0)	0 (0.0)	1 (100.0)	
Surgical margin				0.021
Positive	12 (38.7)	15 (48.4)	4 (12.9)	
Negative	14 (24.6)	42 (73.7)	1 (1.8)	
RP PNI				0.006
Present	22 (40.7)	28 (51.9)	4 (7.4)	
Absent	4 (11.8)	29 (85.3)	1 (2.9)	
Extraprostatic extension				0.002
Present	11 (52.4)	7 (33.3)	3 (14.3)	
Absent	15 (22.4)	50 (74.6)	2 (3.0)	
RP pattern 4 ratio				0.061
1–5%	1 (50.0)	1 (50.0)	0 (0.0)	
6–10%	5 (62.5)	3 (37.5)	0 (0.0)	
11–20%	4 (57.1)	3 (42.9)	0 (0.0)	

Table 4. Continue

Variable	Upgraded *n* (%)	Same *n* (%)	Downgraded *n* (%)	p
RP pattern 4 ratio				0.061
21–30%	3 (50.0)	2 (33.3)	1 (16.7)	
31–40%	0 (0.0)	2 (100.0)	0 (0.0)	
61–70%	2 (100.0)	0 (0.0)	0 (0.0)	
71–80%	0 (0.0)	2 (100.0)	0 (0.0)	
81–90%	0 (0.0)	0 (0.0)	1 (100.0)	
>90%	0 (0.0)	1 (100.0)	0 (0.0)	
RP tertiary pattern				0.232
Present	1 (25.0)	2 (50.0)	1 (25.0)	
Absent	25 (29.8)	55 (65.5)	4 (4.8)	

RP: Radical prostatectomy, PNI: Perineural invasion, GG: Grade group

stands out as the factor showing the strongest association with GG change (p=0.002). Upgrading was observed in 52.4% of cases with EPE, a rate clearly above that of cases without EPE (22.4%). This finding once again confirms the well-established relationship between EPE and high-grade tumor biology. Studies in the literature have highlighted the role of pre-operative MRI findings in predicting biopsy-prostatectomy GG concordance and the presence of EPE.[19] Similarly, surgical margin positivity was also found to be significantly associated with GG change (p=0.021). Park et al.[14] demonstrated that rates of EPE and positive surgical margins were significantly higher in upgraded GS groups. Perineural invasion in the prostatectomy material was also significantly associated with GG change (p=0.006), and this parameter has been evaluated as an indicator of aggressiveness associated with recurrence.[16] Ozkaya et al.[20] examined the relationship between clinical and histopathological parameters in TRUS biopsies and upgrading across different risk groups, emphasizing that biopsy-derived features play an important role in determining the risk of upgrading.

Age and pre-operative PSA level showed no statistically significant association with GG change in our study (p=0.685 and p=0.373, respectively). The independent predictive role of PSA is debated in the literature; while some studies have identified PSA as an independent determinant of GS upgrading,[11] others have shown that PSA's contribution weakens when evaluated together with biopsy-derived parameters.[6] The fact that only four patients were under 55 years of age in our series limited reliable statistical evaluation of this subgroup.

This study has some methodological limitations. Due to its retrospective design, selection bias and unobserved confounding variables may have affected the analysis. The number of patients included reduced statistical power, particularly in higher GG subgroups. Since all patients received standard 12-core TRUS systematic biopsy, comparison with mpMRI fusion biopsy was not possible. The literature has demonstrated that combined biopsy approaches significantly increase concordance and reduce upgrading rates compared to TRUS systematic biopsy.[7] Furthermore, data on prostate volume, PSA density, and tumor multifocality could not be included in the analyses, limiting the evaluation of potential confounding variables.

CONCLUSION

This study demonstrates that parameters already present in the routine pathology report – tumor volume, perineural invasion, and pattern 4 ratio – provide valuable information for predicting grading concordance. These findings emphasize the importance of systematically incorporating existing histopathological data into treatment decisions without requiring additional technical investment. Given that grading discordance cannot be completely prevented, it is considered that a multidisciplinary approach in which clinicians and pathologists jointly interpret these parameters will play a decisive role in post-biopsy patient management.

DECLARATIONS

Ethics Committee Approval: The study protocol was approved by the University of Health Sciences, Gaziosmanpasa Training and Research Hospital Ethics Committee (No: 82, Date: 22/04/2026).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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