Profesional paper

COMPARATIVE ANALYSIS OF PATHOHISTOLOGICAL RESULTS FROM PROSTATE BIOPSY SAMPLES AND RADICAL PROSTATECTOMY SPECIMENS – OUR EXPERIENCES

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ABSTRACT

Introduction: The diagnosis of prostate cancer has seen significant advancements in recent decades, primarily due to the increased accuracy of diagnostic tools and histopathological techniques. Among these, prostate biopsies and specimens from radical prostatectomies play key roles in the diagnosis, staging, and treatment of prostate cancer (Ca) (1). This paper focuses on a comparative analysis of the pathohistological results obtained from prostate biopsy samples and specimens after radical prostatectomy, explaining their differences and implications for clinical practice.

Prostate cancer remains one of the most common malignancies among men worldwide. Early detection and accurate histopathological analysis are crucial for effective treatment and improving patient outcomes. Prostate biopsy, often guided by ultrasound, is the standard diagnostic procedure for detecting prostate cancer. However, it provides limited tissue samples that often fail to represent the full extent of the tumor or its heterogeneity. Compared to this, specimens from radical prostatectomies, obtained after the surgical removal of the prostate gland, offer a clearer picture of the malignancy's characteristics by determining tumor size and location, the degree of invasiveness, and the status of surgical margins (2).

Materials and Methods: The study includes 105 patients who underwent TRUS (transrectal ultrasound-guided prostate biopsy) at the Urology Department of the General Hospital "8th September" in Skopje over a three-year period (from early 2021 to the first half of 2024). The biopsy samples were processed and analyzed at the Pathohistology Department. After confirming prostate cancer, patients underwent surgical treatment—radical prostatectomy (open or laparoscopic)—and the specimens obtained during the operation were analyzed again at the same Pathohistology Department in the General Hospital "8th September" in Skopje.

Demographic data, serum PSA levels, prostate size, pathological stage, and malignancy grade were recorded. The data obtained from the study were statistically analyzed and presented using mean values, percentages, tables, and graphs.

Objectives: To determine the pathohistological characteristics of TRUS biopsy samples to make informed decisions regarding surgical or conservative treatment for prostate cancer. Comparative analysis of pathohistological findings and differences between Gleason Scores from prostate biopsy samples and radical prostatectomy specimens. Identifying the most common pathohistological characteristics of prostate cancer as predictive factors for determining appropriate postoperative treatment.

Results:Out of the 105 patients included in the study, 50 patients (48%) showed identical pathohistological findings (Gleason Score) in both the biopsy and radical prostatectomy specimens. However, in 55 patients (52%), there was a significant difference, with the Gleason Score from radical prostatectomy specimens being higher in most cases.

Conclusion:

The comparative analysis of pathohistological results from prostate biopsy samples and radical prostatectomy

specimens highlights the complementary nature of these diagnostic methods. While biopsies are indispensable for initial diagnosis and treatment planning, radical prostatectomy specimens provide a definitive pathological assessment, offering insights that guide postoperative monitoring and long-term care.

Understanding the advantages and limitations of each method is crucial for optimizing patient outcomes. Future advancements in imaging diagnostics, molecular diagnostics, and artificial intelligence are expected to bridge the gap between biopsy and prostatectomy findings, enhancing the precision of prostate cancer diagnosis and treatment.

INTRODUCTION

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OBJECTIVES

- To determine the pathohistological characteristics of TRUS biopsy samples to make informed decisions regarding surgical or conservative treatment for prostate cancer.

- Comparative analysis of pathohistological findings and differences between Gleason Scores from prostate biopsy samples and radical prostatectomy specimens.

- Identifying the most common pathohistological characteristics of prostate cancer as predictive factors for determining appropriate postoperative treatment.

DISCUSSION

Prostate biopsy is a minimally invasive procedure that allows for the collection of tissue samples for pathohistological analysis. In contrast, radical prostatectomy involves the surgical removal of the entire prostate, enabling a complete and precise assessment of the pathological characteristics of the carcinoma. This analysis explores the differences and similarities in the pathohistological findings obtained through these two approaches, with a particular focus on the Gleason Score as an indicator of tumor aggressiveness.

The Gleason Score is a grading system used to evaluate the aggressiveness of prostate cancer (Ca) by examining the pattern of cancer cells in prostate biopsy or surgical specimens. This score is essential for determining the prognosis and treatment options for patients with prostate cancer.

Gleason Pattern:

Prostate cancer cells are graded based on how closely they resemble normal prostate tissue. Scores range from 1 to 5, where 1 indicates the least abnormal tissue and 5 indicates the most abnormal. Pathologists examine the most common and second most common patterns of cancer cells and assign a grade to each.

GleasonScore: The final score is the sum of these two grades. For example, if the most common pattern is graded as 3 and the second most common as 4, the Gleason Score would be 7 (3+4). Scores typically range from 6 to 10, with higher scores indicating more aggressive cancer:

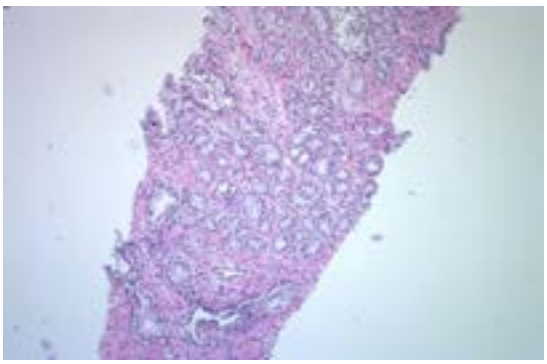
6 or less: Low-grade Ca (well-differentiated)

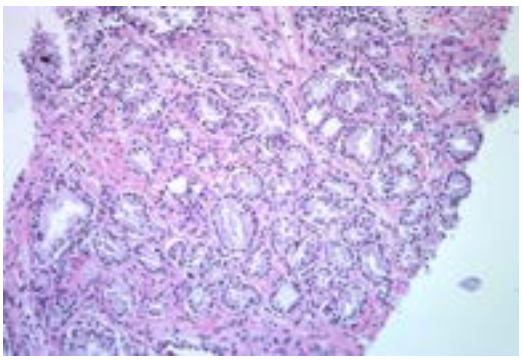
7: Intermediate-grade Ca (further divided into 3+4 or 4+3) (moderately differentiated)

8-10: High-grade Ca (poorly differentiated–highly invasive)

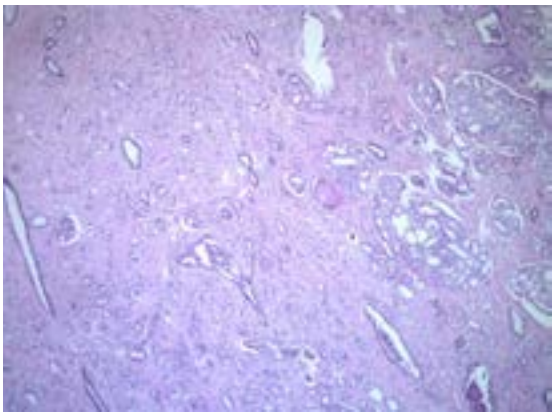
Significance: The Gleason Score helps physicians predict the aggressiveness of the cancer and guide treatment decisions. A higher Gleason Score indicates a more aggressive cancer requiring more intensive treatment, while a lower score usually suggests a less aggressive form of the disease.

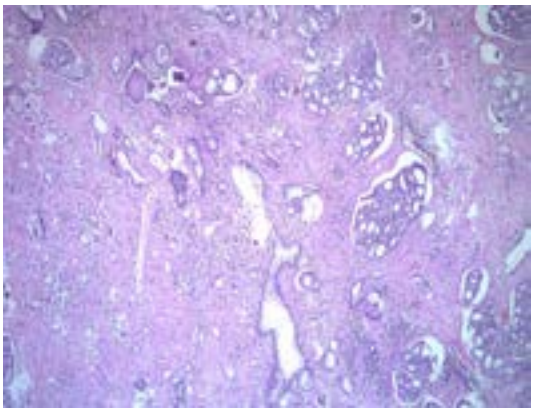
Understanding the Gleason Score is crucial for both clinicians and patients when planning treatment strategies, whether surgery, radiation, or other therapies.





(Example 1. Specimen from prostate biopsy) There are areas of varying extent with a neoplastic proliferation of malignant epithelial neoplasm with characteristics of acinar prostate cancer and a histoarchitectural appearance of Gleason score 3+3.





(Example 2. Specimen from radical prostatectomy) There is a dense fibromuscular prostate stroma with hyperplastic glandular formations, among which focal and diffuse accumulations of hyperchromatic oval cells with prominent nucleoli are observed, irregularly arranged in nests, sheets, small acinar formations, and individual cells. In some areas, glandular formations with fenestrations in the lumen are observed. The finding corresponds to a Gleason score of 3+4.

Pathohistological Evaluation of Prostate Biopsies: Prostate biopsies are usually performed under ultrasound or magnetic resonance (MRI) guidance. During this procedure, multiple cores are taken from different zones of the prostate. Key parameters assessed in biopsy samples include:

Gleason Scale: Provides critical information on tumor aggressiveness.

Tumor Volume: The percentage of cores involved and the extent of tumor invasion in each core.

Perineural Invasion (PNI): The presence of cancerous cells

around nerves, which may indicate a higher likelihood of extraprostatic extension.

Although prostate biopsies are indispensable for initial diagnosis, their limitations include sampling errors, underestimation of tumor grade, and inability to detect multifocal disease.

Pathohistological Evaluation of Radical Prostatectomy Specimens: Radical prostatectomy specimens provide a comprehensive evaluation of the prostate gland. The entire organ is sectioned and analyzed, allowing pathologists to assess:

Extent and Staging of Tumor: The anatomical extent of the tumor, including extraprostatic extension and seminal vesicle invasion.

Surgical Margins: Presence or absence of cancer cells at the surgical margins indicates the completeness of tumor resection.

Lymph Node Involvement: When lymphadenectomy is performed, lymph node involvement can be assessed.

Final Gleason Score: The larger tissue volume allows for a more accurate determination of the Gleason Score.

Radical prostatectomy specimens often reveal additional pathological features not identified in biopsy samples, such as higher tumor grade, multifocality, or invasion of adjacent structures.

Similarities and Differences: Many studies have investigated the similarity between biopsy findings and radical prostatectomy specimens. Key conclusions include:

Gleason Scale Similarities: While biopsies provide an initial Gleason Score, discrepancies often occur. Upgrading (assigning a higher Gleason Score) or downgrading (assigning a lower Gleason Score) happens in a significant proportion of cases when comparing biopsies to prostatectomy specimens. Upgrading is more common and has implications for treatment planning.

Tumor Volume: Biopsies tend to underestimate the true tumor volume due to limited sampling, while radical prostatectomy specimens provide a more accurate assessment of tumor extent.

Multifocal Disease: Multifocality is a common feature of prostate cancer. Biopsies may miss secondary or tertiary cancer foci, which are often detected in prostatectomy specimens.

Extraprostatic Extension and Margins: Biopsies cannot reliably determine the status of extraprostatic extension or surgical margins, which are crucial for prognosis and postoperative follow-up.

Clinical Implications The differences between biopsy findings and prostatectomy specimens have significant clinical implications:

Risk Stratification: Accurate grading and staging are essential for stratifying patients into risk categories, guiding decisions on treatment such as active surveillance, surgery, or radiotherapy.

Treatment Planning: Underestimation of tumor grade or extent in biopsies may lead to undertreatment, while overestimation can result in overtreatment.

Prognosis: Pathological findings from radical prostatectomy specimens provide a clearer prognosis, aiding in predicting recurrence and long-term outcomes.

Research and Biomarkers: Comprehensive pathological analysis of prostatectomy specimens contributes to the identification of new biomarkers and understanding tumor biology.

Advantages and Limitations of Each Method

Prostate Biopsy: Advantages: Minimally invasive, diagnostic utility, suitable for repeated sampling.

Limitations: Sampling errors, underestimation of grade and volume, inability to assess extraprostatic extension.

Radical Prostatectomy: Advantages: Complete pathological evaluation, precise staging, and prognostic insights.

Limitations: Invasive procedure, associated with morbidity, and limited applicability in patients unsuitable for surgery.

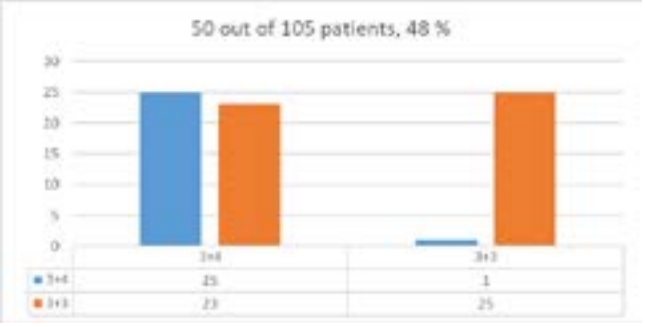
RESULTS

Among the 105 patients included in the study, 50 patients (48%) had identical pathohistological results (Gleason Score) from both biopsy and radical prostatectomy specimens. However, in 55 patients (52%), there were significant differences, with the Gleason Score from radical prostatectomy specimens being higher in most cases.

No.	Patient ID	Gleason score biopsy	G.S radical prostatectomy	PSA before procedures
1	97298	3+4	3+3	5.5
2	111159	3+3	3+4	152.0
3	35200	3+4	4+3	7.84
4	103723	3+4	4+3	17.8
5	153539	3+4	4+3	9.32
6	103968	3+4	4+3	94
7	343248	3+3	3+3	5
8	203856	3+3	4+3	9.63
9	239588	3+3	3+3	17
10	40562	3+3	3+3	10.6
11	199034	3+3	3+3	8.6
12	80060	4+3	4+5	24
13	419261	3+3	3+3	10
14	130892	3+3	3+3	9.5
15	413506	3+3	3+4	12.94
16	370395	3+3	3+3	11.4
17	295961	3+3	3+3	13.5
18	416004	3+3	3+4	7.8
19	419288	3+3	3+4	8.9
20	25941	3+3	3+4	4.09
21	143685	3+4	3+4	15
22	350431	3+4	3+4	9.34
23	421396	3+3	3+4	14.82
24	239986	3+4	3+4	7.18
25	221989	3+4	4+3	37
26	171952	3+3	3+3	4.28
27	191820	3+3	4+3	8.15
28	212284	3+3	3+4	8.67
29	161609	3+3	3+4	14
30	210216	3+3	3+3	6.1
31	434611	3+3	3+3	7.5
32	380407	3+4	3+4	5.8
33	430677	3+3	3+3	5.5
34	131954	3+3	4+3	11.9
35	378405	3+4	4+3	12+3
36	221353	3+4	4+3	6.4
37	425026	3+4	3+4	7.77
38	191296	3+4	3+4	8.4
39	441412	3+4	3+4	12.3
40	459798	3+4	4+3	26
41	457316	3+4	4+3	15.3
42	373505	3+4	4+3	14
43	455327	3+4	3+4	25.9
44	121439	3+3	4+3	4.47
45	454599	3+3	3+4	20
46	459941	3+3	3+3	5.63
47	460399	3+3	3+3	4.27
48	309223	3+3	3+3	6.87
49	466943	3+4	3+4	25.6
50	468340	3+3	3+4	14.2
51	465590	3+3	3+3	11.17
52	134752	3+3	3+3	6.3
53	26866	3+3	3+4	8.5
54	469198	3+4	4+3	9.2
55	143120	3+3	3+3	7.83
56	191876	3+3	3+4	14.6
57	421356	3+4	3+4	6.72
58	53377	3+3	3+3	4.69
59	81884	3+4	4+3	46
60	441863	3+4	3+4	12
61	242220	3+4	3+4	13.53
62	329296	3+3	3+4	12.2
63	148031	3+4	4+5	16.9
64	449737	3+3	3+3	8.61
65	448373	3+3	3+4	8.3
66	448426	3+4	4+3	19.1
67	450773	3+4	4+3	11.2
68	445900	3+4	3+4	7.6
69	63284	3+4	3+4	12
70	451461	3+4	4+5	19.2
71	451921	3+4	4+4	11
72	445082	3+3	3+4	21.5
73	166706	3+4	3+4	8.6
74	65478	3+3	3+4	23.03
75	127769	3+4	3+4	7.6
76	22799	3+4	4+5	15
77	444915	3+3	3+4	12.8
78	199662	3+4	4+5	23.9
79	463149	3+4	3+5	18.9
80	461488	3+3	3+4	6.9
81	122940	3+4	4+3	17.4
82	475257	3+4	4+3	55
83	410987	3+3	3+3	7.4
84	470964	3+3	3+4	8.13
85	397186	3+4	4+3	10.6
86	466707	3+3	3+4	17.00
87	456533	3+4	3+4	30.07
88	473582	3+3	3+3	5.31
89	480667	3+4	3+4	9.35
90	476684	3+4	3+4	5.13
91	228709	3+3	3+4	6.01
92	483279	3+4	3+4	8.5
93	479671	4+3	4+5	28
94	51177	3+4	3+4	17.5

95	481212	3+4	4+5	11.7
96	131333	3+4	4+5	34.3
97	476344	3+3	3+4	12
98	88610	3+3	3+3	11
99	851	3+3	3+3	8.32
100	484919	3+3	3+4	6.12
101	483991	3+4	3+4	25
102	100459	3+4	3+4	4.6
103	488818	3+4	3+4	12.5
104	450097	3+4	3+4	4.9
105	491283	3+3	3+3	5.4

The same result in both columns was observed in 50 out of a total of 105 patients, or 48%.



Gleason score biopsy & G.S radical prostatectomy	
	3+3 ; 3+4
Patients with the same result	50
Total number of patients	105
% Participation	47,6%

PSA findings

PSA before procedures			
Result	od 4 do 10	od 10,1 do 20	nad 20
Total number of patients	51	38	16
	105	105	105
% Participation	48,6%	36,2%	15,2%

CONCLUSION

The comparative analysis of histopathological results from prostate biopsy samples and radical prostatectomy specimens highlights the complementary nature of these diagnostic methods. While biopsies are indispensable for initial diagnosis and treatment planning, radical prostatectomy specimens provide definitive pathological evaluation, offering insights that guide postoperative follow-up and long-term care.

Understanding the strengths and limitations of each method is crucial for optimizing patient outcomes. Future advancements in imaging diagnostics, molecular diagnostics, and artificial intelligence are expected to bridge the gap between biopsy and prostatectomy findings, enhancing the precision of prostate cancer diagnosis and treatment.

Recommendations for Improvement:

- Utilizing MRI-guided biopsies for better representativeness.
- Adopting “Fusion Imaging” biopsy as a routine diagnostic procedure.
- Increasing the number of samples taken during biopsy.
- Advancing histopathological techniques for analysis.

Future research should focus on developing non-invasive methods with greater accuracy, which will help improve clinical practice and optimize prostate cancer treatment (24)(25).

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