Section: Pathology

Original Research Article

HISTOMORPHOLOGICAL SPECTRUM OF PROSTATIC MALIGNANCY AND ITS CORRELATION WITH SERUM PROSTATE SPECIFIC ANTIGEN LEVEL IN TRUCUT BIOPSY AND SPECIMEN OF PROSTATE

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ABSTRACT

Background: Prostatic carcinoma is one of the most frequently diagnosed malignancies among elderly men worldwide. Histopathological evaluation through trucut biopsy and prostatectomy specimens remains the cornerstone of diagnosis and grading. Prostate Specific Antigen (PSA) is a widely used serological marker that assists in the early detection and monitoring of prostatic malignancy. However, its correlation with histological patterns and grade provides a better understanding of tumor biology and prognosis. This study aims to analyze the histomorphological spectrum of prostatic malignancies observed in trucut biopsy and prostatectomy specimens, thereby identifying the prevalent histological types and patterns. Additionally, it seeks to evaluate the correlation between serum prostate-specific antigen (PSA) levels and the histological types and grades of prostatic carcinoma. By comparing PSA levels with corresponding Gleason scores and histological subtypes, the study endeavors to determine the diagnostic and prognostic value of PSA in assessing tumor aggressiveness and guiding clinical management. **Materials and Methods:** This observational cross-sectional study was conducted over a period of one year at a tertiary care center. A total of 58 patients diagnosed with prostatic lesions based on clinical presentation and radiological suspicion were included. Trucut biopsies and prostatectomy specimens were histopathologically examined and classified based on the WHO classification and Gleason grading system. Serum PSA levels at the time of diagnosis were recorded. Statistical analysis was performed to assess the correlation between PSA levels and histological findings. **Result:** Out of the 58 cases, 45 (77.6%) were diagnosed as prostatic adenocarcinoma, 8 (13.8%) as fibromusculoglandular hyperplasia, and 5 (8.6%) as xanthogranulomatous prostatitis. Among the malignant cases, the majority were acinar adenocarcinomas. The Gleason score ranged from 6 to 10, with a predominance of scores between 7 and 8. A positive correlation was observed between increasing Gleason scores and serum PSA levels. Mean PSA levels were significantly higher in high-grade tumors (>20 ng/ml), and many cases with scores 9–10 had PSA levels exceeding 100 ng/ml. Neural invasion was noted in 23 (51.1%) cases and was associated with higher PSA levels. Although high-grade prostatic intraepithelial neoplasia (HGPIN) was seen in 27 (60%) cases, it did not show a statistically significant PSA correlation. **Conclusion:** A strong correlation exists between serum PSA levels and histological grade and invasiveness of prostatic carcinoma. Trucut biopsy remains a valuable diagnostic tool, and combining histomorphological assessment with PSA levels enhances diagnostic accuracy and aids in predicting tumor aggressiveness. Early detection and grading using these parameters can help guide appropriate management strategies in patients with prostatic malignancy.

INTRODUCTION

Prostate cancer (PCA) is the second most common cause of cancer and the sixth leading cause of cancer death among men worldwide. The worldwide PCa burden is expected to grow to 1.7 million new cases and 499 000 new deaths by 2030 simply due to the growth and aging of the global population.[1]

Previously it was thought, that prevalence of prostate cancer in India is far lower as compared to the western countries but with the increased migration of rural population to the urban areas, changing life styles, increased awareness, and easy access to medical facility, more cases of prostate cancer are being picked up and it is coming to the knowledge that we are not very far behind the rate from western countries.[2]

In large Indian cities like Delhi, Kolkatta, Pune and Thiruvananthapuram, third leading site of cancer in cities like Bangalore and Mumbai and it is among the top ten leading sites of cancers in the rest of the population based cancer registries (PBCRs) of India.[2]

Prostate cancer is somewhat unusual when compared with other types of cancer. This is because many prostate tumors do not spread quickly to other parts of the body. Some prostate cancers grow very slowly and may not cause symptoms or problems for years or ever.[3]

Even when prostate cancer has spread to other parts of the body, it often can be managed for a long time. So people with prostate cancer, and even those with advanced prostate cancer, may live with good health and quality of life for many years. However, if the cancer cannot be well controlled with existing treatments, it can cause symptoms like pain and fatigue and can sometimes lead to death.[4]

The most common histology found in prostate cancer is called adenocarcinoma. Other, less common histologic types, called variants, include neuroendocrine prostate cancer and small cell prostate cancer. These variants tend to be more aggressive, produce much less PSA, and spread outside the prostate earlier.[4]

There are no initial or early symptoms in most cases, but late symptoms may include fatigue due to anemia, bone pain, and paralysis from spinal metastases, and renal failure from bilateral ureteral obstruction.[4]

Prostate cancer risk factors include male gender, older age, positive family history, increased height, obesity, hypertension, lack of exercise, persistently elevated testosterone levels, Agent Orange exposure, and ethnicity.[5-7]

The present study aims to evaluate the histomorphological spectrum of prostatic malignancies and investigate its correlation with serum prostate-specific antigen (PSA) levels in trucut biopsies and surgical specimens of the prostate. The primary objective is to identify and classify the various histopathological patterns of prostatic carcinoma, predominantly adenocarcinoma, based on established grading systems such as the Gleason score. Additionally, the study seeks to assess the relationship between PSA levels and the degree of malignancy, as elevated PSA often serves as a marker for both the presence and progression of prostate cancer. Establishing this correlation may aid in improving diagnostic accuracy, guiding treatment decisions, and predicting prognosis.

MATERIALS AND METHODS

Study Design: This was an observational cross sectional study.

Place of Study: Department of Pathology, Burdwan Medical College & Hospital, in collaboration with Department of Biochemistry, Burdwan Medical College & Department of Urology,Burdwan Medical College.

Period of Study: About one and half year (18 months)

- Data Collection: 16 months
- Data Analysis: 1 month
- Data Interpretation: 1month

Study Population: Patients attending the Department of Uurology of Burdwan Medical College and hospital, having complaint of lower urinary tract obstruction symptoms like increase frequency, poor stream, urgency, hesitancy, incomplete voiding, h/o prostatomagaly, dysuria, high PSA level were selected. Digital rectal examination with grade of prostatomegaly was noted. Patients having Grade I to grade III with high PSA level were selected for prostate biopsy &TURP specimens was collected and further processed in the Pathology department of Burdwan Medical College and Hospital for Histomorphological examination.

Sample Size: 58

Inclusion Criteria:

- Patients who underwent Trans Rectal Ultrasound Guided prostate biopsy
- Specimen of Prostate (Patient whose operation was done)

Exclusion criteria:

- Patient not giving consent
- No SPA report
- Inadequate biopsy material

Study Variables:

- Age of the patients
- Clinical features
- Previous biopsy reports (if available)
- Serum PSA level

Study Tools:

- Consent form
- Case record form
- Previous PSA report
- light microscope
- Binocular microscope.
- Computer and statistical software.

Statistical Analysis:

The collected data were compiled in Microsoft Excel and analyzed using IBM SPSS software version 26.0. Descriptive statistics were employed to summarize

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demographic data, histological findings, and PSA levels. Continuous variables such as PSA values were expressed as mean ± standard deviation (SD), while categorical variables like histological diagnosis and Gleason grades were expressed in frequencies and percentages. The correlation between serum PSA levels and histopathological parameters (e.g., Gleason score, presence of high-grade prostatic intraepithelial neoplasia [HGPIN], and neural invasion) was assessed using the Pearson correlation coefficient and Spearman's rank correlation for non-parametric variables. Comparison of PSA levels across different Gleason grade groups was performed using the one-way ANOVA test. Where significant differences were noted, post hoc Tukey's test was applied. Chi-square (χ^2) test was used to evaluate associations between categorical variables, such as the presence of neural invasion and HGPIN with Gleason grade and PSA categories. A p-value < 0.05 was considered statistically significant throughout the analysis.

RESULTS

Table 1: Distribution of Demographic Characteristics, Type of Specimen, and Clinical Presentation in the Study Population (n = 58)

Demographic variables		Frequency	Percentage	p value
Age Group	50-60 years	13	22.4	< .00001
	61-70 years	29	50	
	71-80 years	13	22.4	
	>80 years	3	5.2	
	Total	58	100	
	Mean Age	66.60 ±8.09		
Type of Specimen	TURP	37	63.8	.00298
	Trucut Biopsy	21	36.2	
	Total	58	100	
Clinical Presentation	Frequent Urination	15	25.9	.0002
	Difficulty Voiding	13	22.4	
	Incomplete Voiding	11	19	
	Hesitancy	10	17.2	
	Acute Urinary Retention	7	12.1	
	Dysuria	6	10.3	
	Poor Stream	4	6.9	
	Nocturia	4	6.9	
	Hematuria	2	3.4	
	Urgency	1	1.7	

Table 2: Distribution of DRE Grading, Serum PSA Levels, and Gleason Grading among Study Participants

		Frequency	Percentage	P value
DRE Grading	I	11	19	.00854
	II	24	41.4	
	III	23	39.6	
	Total	58	100	
PSA Level (ng/ml)	<4.0 (ng/ml)	2	3.4	< .00001
	4.0-10.0 (ng/ml)	5	8.6	
	10.1-20.0 (ng/ml)	8	13.8	
	>20.0 (ng/ml)	43	74.1	
	Total	58	100	
Gleason Grading	6 (3+3)	8	17.8	3.2984
	7 (3+4)	12	26.7	
	7 (4+3)	12	26.7	
	8 (4+4)	6	13.3	
	9 (4+5)	5	11.1	
	9 (5+4)	1	2.2	
	10 (5+5)	1	2.2	
	Total	45	100	

Table 3: Histopathological Findings in Prostate Specimens of the Study Population (n = 58)

Histopathological Findings	Frequency	Percentage	p value
Prostatic Adenocarcinoma	45	77.6	< .00001
Fibromusculoglandular Hyperplasia	8	13.8	
Xanthoma Granulomatous Prostatitis	5	8.6	
Total	58	100	

Table 4: Correlation between Histopathological Findings and Mean Serum PSA Levels

Histopathological Findings	PSA Level (ng/ml)	
	Mean	±SD
Prostatic Adenocarcinoma	96.99	±154.87
Fibromusculoglandular Hyperplasia	9.1	±5.50
Xanthoma Granulomatous Prostatitis	14.41	±3.10
Statistical Inference	p value:<0.0001	

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Table 5: Distribution of High-Grade Prostatic Intraepithelial Neoplasm (HGPIN) and Neural Invasion among Cases of Prostatic Adenocarcinoma (n = 45)

		Frequency	Percentage	p value
High grade Prostatic Intraepithelial Neoplasm (HGPIN)	Present	27	60	.05744
	Absent	18	40	
	Total	45	100	
Neural Invasion	Present	23	51.1	
	Absent	22	48.9	
	Total	45	100	

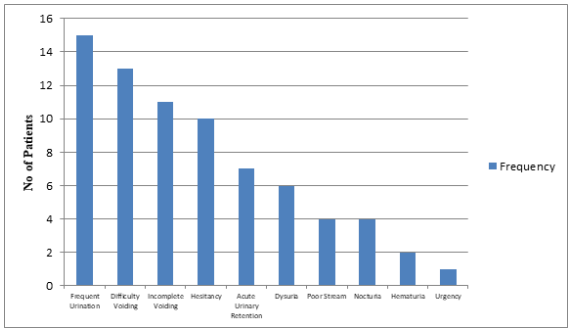

Figure 1: Distribution of Demographic Characteristics, Type of Specimen, and Clinical Presentation in the Study Population (n = 58)

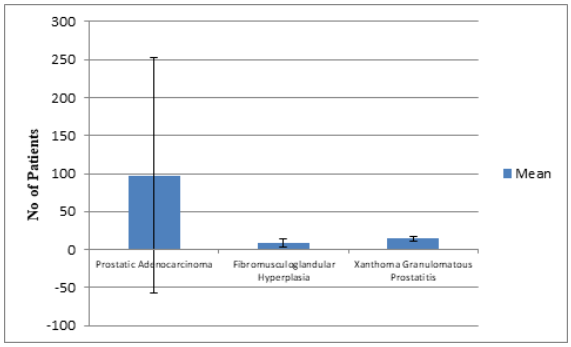

Figure 2: Correlation between Histopathological Findings and Mean Serum PSA Levels

Among the 58 patients included in the study, the majority (50%) belonged to the 61–70 years age group, followed by 22.4% each in the 50–60 and 71–80 years groups, and 5.2% were over 80 years of age. The mean age of the study population was 66.60 ± 8.09 years, with a statistically significant distribution across age groups ($p < 0.00001$). Regarding the type of specimen, most patients underwent transurethral resection of the prostate (TURP) (63.8%), while 36.2% had a trucut biopsy, with a significant difference in specimen type distribution ($p = 0.00298$). The most common clinical presentation was frequent urination (25.9%), followed by difficulty voiding (22.4%), incomplete voiding (19%), hesitancy (17.2%), and acute urinary retention (12.1%). Other presenting symptoms included dysuria (10.3%), poor stream and nocturia (6.9% each), hematuria (3.4%), and urgency (1.7%), with an overall statistically significant variation in symptom distribution ($p = 0.0002$).

Digital rectal examination (DRE) grading among the 58 patients showed that 41.4% had Grade II findings, followed by 39.6% with Grade III and 19% with Grade I, with the distribution being statistically significant ($p = 0.00854$). Serum PSA levels were markedly elevated in the majority of patients, with 74.1% having PSA >20 ng/ml, 13.8% between 10.1–20.0 ng/ml, 8.6% between 4.0–10.0 ng/ml, and only 3.4% below 4.0 ng/ml. This distribution showed strong statistical significance ($p < 0.00001$). Among the 45 cases of prostatic adenocarcinoma, Gleason scores were most commonly 7 (3+4) and 7 (4+3), each comprising 26.7% of cases. Scores of 6 (3+3) were observed in 17.8%, while higher grades—Gleason 8, 9, and 10—were seen in 13.3%, 13.3% (combined), and 2.2% respectively. The distribution of Gleason grades was not statistically significant ($p = 3.2984$).

Histopathological examination revealed that prostatic adenocarcinoma was the most common diagnosis, identified in 77.6% (n=45) of the cases. Fibromusculoglandular hyperplasia was observed in 13.8% (n=8), while xanthogranulomatous prostatitis accounted for 8.6% (n=5). The distribution of these findings was highly statistically significant ($p < 0.00001$).

In the present study, the mean serum PSA levels varied significantly across different histopathological diagnoses. Patients diagnosed with prostatic adenocarcinoma had a markedly elevated mean PSA level of 96.99 ± 154.87 ng/ml, whereas those with fibromusculoglandular hyperplasia had a substantially lower mean PSA of 9.1 ± 5.50 ng/ml. In cases of xanthogranulomatous prostatitis, the mean PSA level was 14.41 ± 3.10 ng/ml. The difference in PSA levels among the three histopathological groups was found to be highly statistically significant ($p < 0.0001$).

In the present study involving 45 cases of prostatic adenocarcinoma, high grade prostatic intraepithelial neoplasm (HGPIN) was observed in 27 cases (60%), while it was absent in 18 cases (40%). The association of HGPIN with prostatic adenocarcinoma approached statistical significance with a p value of 0.05744, suggesting a possible trend but not reaching conventional significance. Neural invasion was detected in 23 cases (51.1%) and was absent in 22 cases (48.9%).

DISCUSSION

In the present study, the majority of patients were in the 61–70 years age group (50%), with a mean age of 66.60 ± 8.09 years, which is consistent with findings from Bostwick et al., who reported peak incidence of prostatic adenocarcinoma in the seventh decade of

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life.[8] Similar age-related trends were also observed by Baig et al., who documented a mean age of 67.2 years among patients with prostatic carcinoma.[9] The predominant method of specimen acquisition was TURP (63.8%), followed by trucut biopsy (36.2%), reflecting institutional preference and clinical presentation, as also seen in the study by Bhatta et al., where TURP specimens constituted 70% of prostate tissue samples.[10] Frequent urination (25.9%) was the most common presenting complaint, aligning with Gupta et al., who reported lower urinary tract symptoms, especially frequency and nocturia, as dominant in their cohort.[11] The majority of patients had Grade II DRE findings (41.4%), comparable to observations by Kumar et al., where intermediate-grade findings were more prevalent than subtle or advanced changes.[12]

The distribution of serum PSA levels was notably skewed toward higher values, with 74.1% of patients exhibiting PSA >20 ng/ml. This trend is in agreement with the study by Hemal et al., where over 65% of prostate cancer patients had PSA levels exceeding 20 ng/ml.[13] Our histopathological results showed that prostatic adenocarcinoma was the most frequent diagnosis (77.6%), followed by fibromusculoglandular hyperplasia (13.8%) and xanthogranulomatous prostatitis (8.6%), mirroring the findings of Abbas et al., who also reported adenocarcinoma as the predominant lesion in 72% of prostatic specimens.[14] PSA levels were highest in adenocarcinoma cases (mean 96.99 ± 154.87 ng/ml), significantly more than in benign conditions like FMGH (9.1 ± 5.50 ng/ml) or xanthogranulomatous prostatitis (14.41 ± 3.10 ng/ml), in line with the findings of Tiwari et al., who demonstrated a similar PSA elevation pattern among malignant and benign prostatic lesions.[15]

In terms of tumor grading, Gleason score 7 (3+4 and 4+3) was most common (53.4%), followed by scores 6, 8, and higher, resembling the distribution seen in the cohort of Iqbal et al., where the majority of prostate adenocarcinoma cases had intermediate-grade tumors.[16] High-grade prostatic intraepithelial neoplasia (HGPIN) was found in 60% of adenocarcinoma cases in our study. This finding closely resembles that of Montironi et al., who emphasized the frequent co-existence of HGPIN with invasive adenocarcinoma and its role as a precursor lesion.[17] Neural invasion was noted in 51.1% of cases, indicating aggressive potential, a finding also corroborated by Ravery et al., who reported perineural invasion in over 50% of prostate carcinoma cases and its association with poor prognosis.[18]

CONCLUSION

The present study highlights the clinical, biochemical, and histopathological spectrum of prostatic lesions, with prostatic adenocarcinoma emerging as the predominant diagnosis, particularly in elderly males, consistent with global and regional literature. A strong correlation was observed between elevated serum PSA levels and malignant pathology, underscoring the utility of PSA as a non-invasive diagnostic and prognostic biomarker. The frequent occurrence of intermediate Gleason scores (particularly 7), high-grade prostatic intraepithelial neoplasia (HGPIN), and neural invasion among adenocarcinoma cases reflects both the diagnostic complexity and potential aggressiveness of the disease. Findings such as the predominance of TURP specimens and common urinary symptoms reinforce the clinical presentation trends seen in similar studies. Overall, the data underscore the importance of integrating clinical findings, PSA levels, and histopathological evaluation for early detection and risk stratification in prostatic disorders, with implications for improving patient outcomes through timely intervention.

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