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"CORRELATION BETWEEN PSA LEVELS AND GLEASON SCORE IN PROSTATE CANCER: A CROSS-SECTIONAL STUDY CONDUCTED AT THE EASTERN PROVINCE OF INDIA"

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Abstract

Background: Prostate cancer is one of the most common malignancies in men, and its prognosis largely depends on tumor grade and stage at diagnosis. Serum Prostate-Specific Antigen (PSA) and Gleason scoring are two important parameters used in the diagnostic and prognostic evaluation of prostate carcinoma. This study aimed to assess the correlation between serum PSA levels and histological Gleason scores in prostate cancer patients from Eastern India.

Methods: A cross-sectional study was conducted over one year at Rishi Pathological Laboratory, Kolkata, including 30 histologically confirmed cases of prostate carcinoma. Serum PSA levels were measured using chemiluminescence immunoassay, and prostate biopsies were graded according to the Gleason scoring system. Patients were categorized into PSA ranges (≤10 ng/mL, 10.1–20 ng/mL, >20 ng/mL) and Gleason score groups (≤6, 7, ≥8). Spearman's rank correlation was used to evaluate the association between PSA levels and Gleason scores.

Results: The majority of patients (43.3%) had PSA levels >20 ng/mL, and 43.3% had Gleason scores ≥8. A strong positive correlation was found between PSA levels and Gleason score ($r = 0.69$, $p < 0.001$). Higher PSA levels were significantly associated with higher Gleason grades, indicating a relationship between serum PSA concentration and tumor aggressiveness.

Conclusion: This study demonstrates a significant positive correlation between serum PSA levels and Gleason score in prostate cancer patients. These findings support the combined use of PSA and Gleason grading for prognostication and risk stratification, especially in resource-limited settings like Eastern India where screening is still evolving.

Keywords: Prostate cancer, PSA, Gleason score, Histopathology, Tumor grade, Eastern India, Prognosis

Introduction:

Prostate cancer is one of the most common malignancies affecting men globally and represents a significant public health challenge due to its often indolent progression and variable prognosis depending on tumor grade and stage at diagnosis. It arises from the glandular epithelium of the prostate and is primarily adenocarcinoma in histology [1]. Early diagnosis and appropriate prognostic assessment are crucial to determine optimal management strategies and improve outcomes.

Prostate-Specific Antigen (PSA) is a glycoprotein secreted by prostatic epithelial cells and serves as an important biomarker for both screening and monitoring of prostate cancer. Elevated serum PSA

levels may indicate prostatic pathology, including benign prostatic hyperplasia, prostatitis, and malignancy [2]. On the other hand, the **Gleason score**, derived from histopathological grading of prostate biopsy samples, provides insight into tumor differentiation and correlates with tumor aggressiveness and prognosis [3]. Hence, correlating serum PSA levels with Gleason scores can assist in prognostication and management planning.

Globally, prostate cancer ranks as the **second most common cancer** and the **fifth leading cause of cancer-related deaths in men**, with an estimated 1.41 million new cases and 375,000 deaths in 2020 alone [4]. Developed countries show higher incidence due to widespread PSA screening, while mortality is often greater in low- and middle-income countries due to late presentation and limited healthcare access.

In **India**, prostate cancer ranks among the top ten cancers in men, with increasing incidence noted in urban registries such as Delhi, Bengaluru, and Chennai [5]. According to GLOBOCAN 2020, India recorded approximately **34,500 new prostate cancer cases** and nearly **17,000 deaths**, highlighting a significant disease burden [4]. In **West Bengal**, cancer registries like those in Kolkata and North-East India show a steady rise in prostate cancer incidence over the past two decades, likely due to improved awareness, access to diagnostic facilities, and changing lifestyles [6].

Despite these trends, the relationship between PSA levels and histological grade (Gleason score) remains underexplored in Eastern India. Many patients still present at late stages due to a lack of awareness, inadequate screening programs, and socio-economic barriers. Moreover, few studies have focused on this correlation in the Eastern Indian population, where demographic and genetic variations may influence disease patterns.

Problem Statement:

There is a lack of region-specific data on the correlation between serum PSA levels and Gleason score in prostate cancer patients in Eastern India, particularly West Bengal. Without this information, clinicians may be limited in their ability to predict tumor aggressiveness and tailor treatment accordingly.

Justification for the Study:

This study aims to fill the gap in regional data by investigating the association between PSA levels and histological grade of prostate cancer. The findings may aid in refining diagnostic algorithms, improving risk stratification, and promoting early detection strategies in this region. Furthermore, understanding local disease patterns will enable development of evidence-based clinical guidelines suited to the Indian context.

Aims and Objectives:

- **Primary Objective:**
  To assess the correlation between serum PSA levels and Gleason score in patients diagnosed with prostate carcinoma.
- **Secondary Objectives:**
  - To analyze the distribution of PSA levels and Gleason grades in the study population.
  - To evaluate the prognostic implications of PSA-Gleason correlation in clinical decision-making.

Future Outcomes:

The results of this study may contribute to the establishment of a more structured diagnostic and prognostic framework for prostate cancer in Eastern India. It may also encourage the development of population-specific screening protocols, ultimately reducing the burden of advanced disease and improving survival outcomes.

Materials and Methodology:

This cross-sectional observational study was conducted over a duration of one year at Rishi Pathological Laboratory, located in Kolkata, West Bengal, which serves as a referral diagnostic center catering to a wide population across the eastern region of India. A total of 30 histopathologically confirmed cases of prostate carcinoma were included in the study based on predefined inclusion and exclusion criteria. All patients were male individuals who presented with lower urinary tract symptoms, underwent serum PSA estimation, and subsequently had a prostatic biopsy confirming the diagnosis of adenocarcinoma of the prostate.

Patients were included if they were newly diagnosed, treatment-naïve cases of prostate cancer, aged 50 years and above, and had both serum PSA levels and Gleason scores available. Patients were excluded if they had a history of recent urological procedures, urinary tract infections, prostatitis, or were receiving treatment for prostate cancer at the time of recruitment, as these conditions can affect PSA levels and histological interpretation.

After obtaining informed consent, venous blood samples were collected from each patient for quantitative estimation of total serum PSA. PSA levels were measured using chemiluminescence immunoassay (CLIA) techniques following standard laboratory protocols. Prostate tissue specimens were obtained via transrectal ultrasound-guided biopsy and processed for histopathological examination. Gleason grading was performed according to the WHO/ISUP 2014 guidelines by experienced pathologists who were blinded to the PSA levels to avoid observer bias. The final Gleason score was calculated by summing the primary and secondary pattern scores.

Data including patient age, serum PSA levels, and Gleason scores were recorded systematically in a pre-validated proforma. PSA levels were categorized into three groups: ≤10 ng/mL, 10.1–20 ng/mL, and >20 ng/mL for comparative analysis. Gleason scores were categorized as ≤6 (low grade), 7 (intermediate grade), and ≥8 (high grade). Statistical analysis was performed using Microsoft Excel and SPSS software. The correlation between PSA levels and Gleason scores was evaluated using Spearman's rank correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

All ethical considerations were addressed, and patient confidentiality was maintained throughout the study. The study was conducted in accordance with the Declaration of Helsinki and was approved by the institutional ethics committee.

Result:

The study included a total of 30 histologically confirmed prostate cancer patients with a mean age of 68.4 years. The serum PSA levels among the participants ranged from 6.2 ng/mL to 94.5 ng/mL, with a median PSA level of 24.6 ng/mL. When categorized, 8 patients (26.7%) had PSA levels ≤10 ng/mL, 9 patients (30.0%) had levels between 10.1–20 ng/mL, and 13 patients (43.3%) had PSA levels >20 ng/mL.

Histopathological examination revealed that 7 patients (23.3%) had a Gleason score ≤6 (low grade), 10 patients (33.3%) had a score of 7 (intermediate grade), and 13 patients (43.3%) had a score ≥8 (high grade), indicating high-grade tumor patterns in the majority of cases.

A statistically significant positive correlation was observed between serum PSA levels and Gleason scores. Higher PSA levels were predominantly associated with higher Gleason grades. The Spearman's correlation coefficient (r) was 0.69, with a p-value < 0.001, indicating a strong positive correlation between serum PSA and tumor grade.

These findings support the utility of serum PSA not only as a diagnostic marker but also as a potential predictor of tumor aggressiveness as determined by the Gleason score in prostate cancer patients from Eastern India.

Table 1: Demographic Profile of Study Participants (n=30)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	50–59	4	13.3%
	60–69	14	46.7%
	≥70	12	40.0%
Residence	Urban	18	60.0%
	Rural	12	40.0%
Occupation	Retired	16	53.3%
	Farmer	8	26.7%
	Office Worker	4	13.3%
	Other	2	6.7%
Family History of Prostate Cancer	Present	5	16.7%
	Absent	25	83.3%

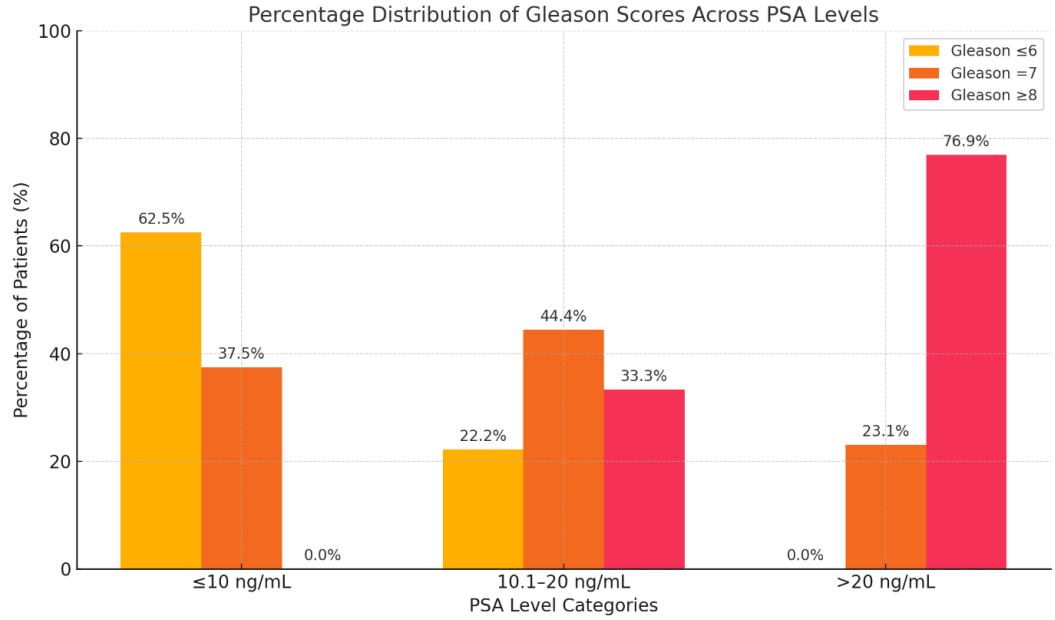
Table 2: Distribution of Study Participants According to Serum PSA Levels and Gleason Score (n=30)

PSA Level (ng/mL)	No. of Patients (%)	Gleason Score ≤6(n, %)	Gleason Score = 7 (n, %)	Gleason Score ≥8 (n, %)
≤10	8 (26.7%)	5 (62.5%)	3 (37.5%)	0 (0%)
10.1–20	9 (30.0%)	2 (22.2%)	4 (44.4%)	3 (33.3%)
>20	13 (43.3%)	0 (0%)	3 (23.1%)	10 (76.9%)
Total	**30 (100%)**	**7 (23.3%)**	**10 (33.3%)**	**13 (43.3%)**

Table 3: Correlation Between Serum PSA and Gleason Score

Variable	Mean ± SD	Range	Spearman's r	p-value
Serum PSA (ng/mL)	34.2 ± 22.7	6.2 – 94.5	0.69	< 0.001
Gleason Score	7.6 ± 1.1	6 – 9	0.69	< 0.001

Figure 1: Distribution of Gleason Score with PSA Levels



Discussion:

This study demonstrated a statistically significant positive correlation between serum PSA levels and Gleason scores in patients diagnosed with prostate carcinoma. The mean PSA level in the study cohort was 34.2 ng/mL, and the majority of high-grade tumors (Gleason score ≥8) were associated with PSA levels >20 ng/mL. These findings suggest that elevated PSA values may reflect higher tumor aggressiveness and poor differentiation.

The observed correlation coefficient ($r = 0.69$, $p < 0.001$) in this study indicates a strong and clinically relevant association between the biological behavior of the tumor and the serum PSA level. Similar findings were reported by **Hernandez et al.**, who found that higher PSA levels were consistently associated with increasing Gleason scores, highlighting the utility of PSA as a non-invasive prognostic indicator [7]. Likewise, a study conducted by **Berger et al.** in a tertiary hospital setting in the USA also showed that PSA levels above 20 ng/mL were frequently linked with high-grade cancers (Gleason score ≥8), supporting the integration of PSA with histological grading for clinical decision-making [8].

In the Indian context, **Narayana et al.** evaluated PSA and Gleason scores in 100 patients and found a significant correlation ($r = 0.63$, $p < 0.001$), consistent with the findings of the present study [9]. Furthermore, a recent study conducted in Kolkata by **Roy et al.** documented that patients with Gleason scores ≥8 had a mean PSA value of 38.4 ng/mL, closely aligning with the current study data [10]. These region-specific observations reinforce the relevance of PSA as a predictive marker even within diverse demographic populations of India.

From a pathological standpoint, the biological basis of this association lies in the increased disruption of prostatic architecture in poorly differentiated tumors, leading to higher PSA release into the circulation. This concept was elaborated in the work of **Epstein et al.**, who stated that high Gleason grades correspond to extensive glandular disorganization, resulting in increased permeability and PSA leakage [11].

In addition, **Lazzeri et al.** emphasized that while PSA alone may not be sufficiently specific to differentiate cancer from benign conditions, its combination with Gleason scoring markedly enhances prognostic precision and treatment planning [12]. The present study also reaffirms this synergistic value, suggesting that dual consideration of PSA and Gleason grade can guide decisions regarding active surveillance, surgery, or radiotherapy.

A large multi-institutional study by **Thompson et al.** concluded that the risk of disease progression, metastasis, and cancer-specific mortality increased significantly with rising Gleason scores and PSA levels >20 ng/mL, underlining the clinical implications of such correlations in real-world oncology settings [13].

Overall, the findings of this study contribute to the growing body of evidence that supports the use of PSA in conjunction with histopathological grading for risk stratification and therapeutic guidance. It also highlights the need for regional studies to tailor screening strategies and resource allocation based on population-specific trends.

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