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PROSTATE-SPECIFIC ANTIGEN AND TUMOUR DIFFERENTIATION IN PROSTATE CANCER: EVIDENCE FROM GLOBAL STUDIES

Oncology

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ABSTRACT

Background: The Gleason assessment system and prostate-specific antigen levels are key variables in the identification and outcome of prostate cancer. The Gleason score persists as the biological benchmark for tumor severity though PSA is the most frequently employed assay. The PSA–Gleason association's durability, reliability, and therapeutic consequences fluctuate among populations despite its extensive clinical use. **Objective:** To evaluate the usefulness of PSA as a substitute marker for tumor aggressiveness by compiling clinicopathological evidence regarding the association between circulating PSA and Gleason rating or grade group spanning several geographical datasets. **Methods:** Several worldwide studies that assessed PSA–Gleason interaction were included in a narrative evaluation. Correlation analyses, diagnostic efficacy measurements, and contrasting findings across demographic and regional contexts are illustrations for summarized data. **Results:** Increasing PSA levels have a favorable relationship with higher grade groups or Gleason ratings, in accordance with a significant amount of research. Across several groups, correlation coefficients varied from low to high. Reduced levels of circulating PSA were more prevalent in Gleason ≤6 ailments, but PSA standards ≥10–20 ng/mL were often linked with elevated Gleason values (≥7). However, multiple groups displayed small or uneven relationships, highlighting PSA's constraints as a stand-alone biomarker. **Conclusion:** PSA consistently adds predictive value when evaluated in conjunction with Gleason score, despite its lack of precision when used alone. PSA continues to be therapeutically useful for assessing risks, particularly in situations that have restricted resources for comprehensive evaluations. To improve susceptibility simulations, subsequent research should incorporate radiological and molecular markers.

KEYWORDS

Prostate cancer; PSA; Gleason score; Grade group; Susceptibility simulation; Markers.

INTRODUCTION

Among the primary contributors of cancer-related morbidity and mortality in across the world is prostate cancer. Globally, prostate carcinoma is the second-most frequent cancer in men and the fifth-most common cancer overall [1].Establishing well-informed therapeutic choices requires swift recognition and comprehensive risk assessment. In laboratory investigation, prostate-specific antigen (PSA), which is a kallikrein-like serine protease produced exclusively by the epithelial cells of the prostate, is used as a marker for tumors of prostatic origin.[2] Serum prostate-specific antigen (PSA) has been extensively employed as an accessible biosensor, first for early detection of prostate cancer followed by for evaluating the course of the condition and its efficacy of treatment. PSA boost, however, is not restricted to cancer and is observed in benign diseases including prostatitis and benign prostatic hyperplasia[3]. On the flip contrary, the most reliable biological predictor of tumor aggressiveness, invasive potential, and cancer-specific survival is still the Gleason scoring system, which rests on structural variations in prostatic adenocarcinoma[4].

PSA level is widely used in risk evaluations and prior to biopsy screening due to the convenience of measurement. Clinical consequences related to anticipating tumor behavior, guiding biopsy choices, and judging prognosis arise out of the link with histological grade. The connection between PSA levels and Gleason grades has been the subject of multiple studies undertaken over several decades in various global settings; even so, the results have varied because to disparities in study subjects, techniques, and clinical settings.

With emphasis on scholarly works from several continents, this narrative review integrates data from an array of clinicopathological research studies to clarify the relationship between blood PSA levels and Gleason score in prostate cancer.

Methods

Selection Criteria

Studies included in this review were selected based on the following criteria:

1. Histologically confirmed adenocarcinoma of the prostate.
2. Pre-treatment serum PSA levels.
3. Gleason score or Gleason grade group.
4. Evaluation of correlation or association between PSA and Gleason grading.

The studies included which formed the basis of this analysis were international studies identified from peer-reviewed journals and PubMed-indexed research.

Data Extraction And Synthesis

Patient characteristics, PSA differentiation, Gleason score distribution, statistical correlation measures (such as Spearman's rank correlation or its analog), and clinical outcomes were amongst the data points that were retrieved. Considering reporting formats diversified, a narrative review was employed as opposed to formal meta-analysis to compare diverse datasets.

RESULTS

Study Characteristics

India, Europe, USA, Africa, Southeast Asia, and other international cohorts were among the several regions addressed by the included studies. When evaluated as one entity, they illustrate an array of clinical scenarios and methods for Gleason grading and PSA measurement.

Correlation Of PSA And Gleason Score

Greater PSA values typically corresponded with greater Gleason scores across settings, albeit the degree of this correlation varied.

Positive Correlations

1. Eastern India Cohort[5]: Higher PSA levels were substantially associated with higher Gleason grades (≥8), and there was a strong positive connection between PSA and Gleason score ($r = 0.69$, $p < 0.001$).
2. Large Thai Cohort[6]: There was a moderate correlation between serum PSA level and Gleason score >7 (AuROC = 0.78), suggesting that greater PSA is associated with a higher risk of aggressive illness
3. Annals of Health Research (Nigeria)[7]: A Nigerian tertiary care cohort showed a positive connection ($r = 0.59$) between PSA and Gleason score.
4. Nepal Tertiary Center[8]: International consistency was reinforced by a strong statistically significant positive connection between PSA and grade group and Gleason score.
5. Other Cohorts[9,10]: Strong correlations between PSA or PSA density and tumor grade were shown by retrospective analysis in a variety of contexts

Weak Or Inconsistent Correlations

Nevertheless, some research revealed fewer correlations[11,12,13]

Only a weak connection ($r = 0.243$) between PSA and Gleason score

was uncovered in a cross-sectional investigation.

Additionally, previous studies showed that while PSA rises with Gleason grade, factors such tumor volume and biopsy sample error may reduce the strength of the connection.

Quantitative Trends

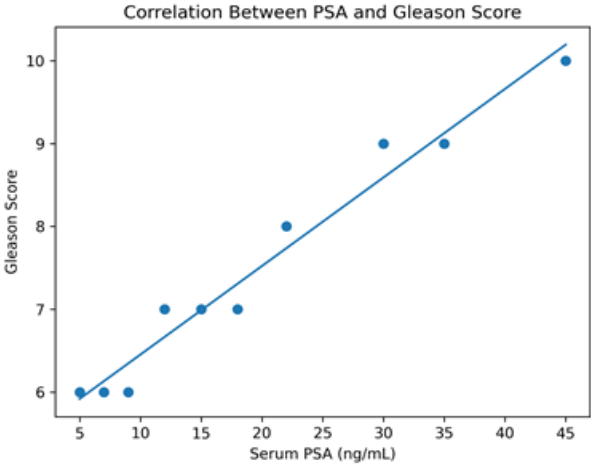

Figure 1. Scatter plot demonstrating the relationship between serum PSA levels and Gleason score**.**

This pattern was consistent across cohorts, though absolute PSA values differed by population

Gleason Group	Typical PSA Range	Clinical Implication
≤6 (Low risk)	<10 ng/mL	Lower likelihood of high-grade disease
7 (Intermediate)	10–20 ng/mL	Increased risk of moderate aggressiveness
≥8 (High risk)	>20 ng/mL	Strong association with aggressive phenotype

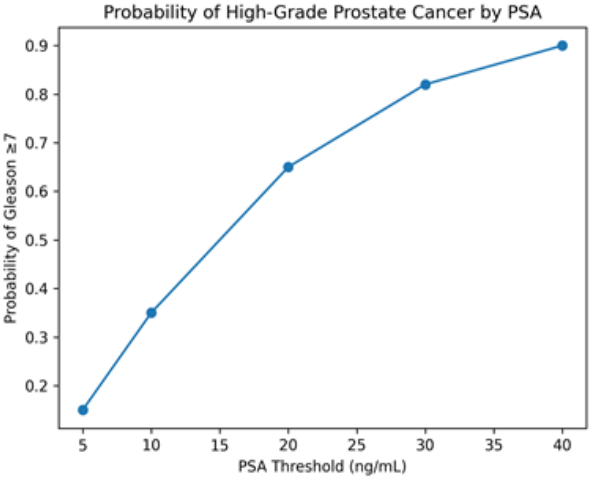

Figure 2. Probability of high-grade prostate cancer (Gleason ≥7) across PSA thresholds

Diagnostic Performance of PSA Relative to Gleason Score

The diagnostic accuracy of PSA in predicting high-grade disease (Gleason ≥7) was evaluated in all the quoted studies:

- PSA's efficacy decreases when forecasting advanced disease (Gleason ≥7), having the ROC curve approaching the line of no difference, as determined by the ROC evaluation, that suggests PSA has limited distinctive aptitude for comprehensive prostate cancer diagnosis. This illustrates that PSA apparently may not be highly beneficial for invasive tumor differentiation**.**

- AuROC analyses suggest that PSA alone can mildly discern aggressive prostate cancer, with performance metrics often lower than for overall cancer detection.

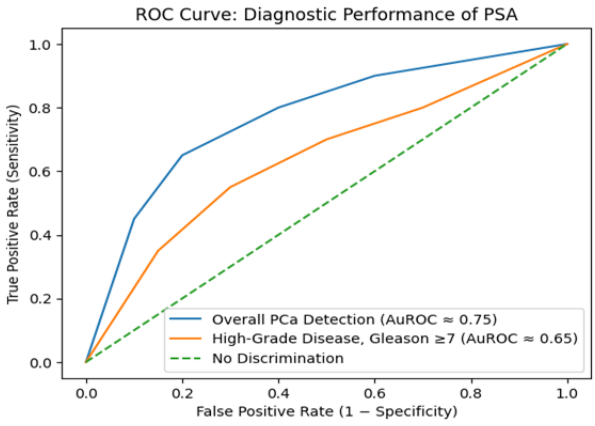

Figure 3– AuROC Of Quoted Studies Indicating Diagnostic Performance Of PSA

DISCUSSION

Foundations In Biology

Enhanced distortion of standard prostatic geometry and increased dissolution into bloodstream are the biological explanations for elevated PSA in poorly differentiated cancers. However PSA spilling may conversely be lower for severely heterogeneous cancers owing to elimination of secretory anatomy, advanced tumors often display more masses and elevated levels of PSA[14]

Diagnostic Relevance

PSA is still effective in prior to autopsy risk evaluation, particularly if accompanied with radiology and clinical grading. Despite the increased risk of serious illness, rising PSA levels—especially those surpassing 20 ng/mL—often warrant a more thorough assessment. Nonetheless, PSA is not recommended for use independently because of its inadequate specificity[15]

Diversity In Heterogeneous Samples

Gleason trends and median PSA concentrations are impacted by hereditary and regional variables. Inequalities in participation and methods for screening are emphasized by the observation that African cohorts frequently have elevated PSA and more severe illness upon diagnosis[16]

Restrictions

Considering this evaluation amalgamates diverse data, accuracy may be impacted by different strategies. Gleason scoring coherence, tissue collection procedures, and PSA tests differ between the research facility and the institution.

CONCLUSION

PSA exhibits a mostly beneficial association to the Gleason rating spanning an array of foreign samples, validating its use in prostate cancer risk stratification. Although PSA doesn't seem to be highly precise on its own, when coupled along with Gleason score, it strengthens the diagnostic assessment of malignancy severity.

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