Correlation Between Total PSA Levels, Gleason Scores and Gleason Grade Groups in Prostatic Adenocarcinoma: A Two-Year Retrospective Study from a South Eastern Nigerian Tertiary Hospital

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ABSTRACT

Background: Prostatic adenocarcinoma remains a significant health burden in Nigeria, with most cases presenting at advanced stages. Understanding relationships between PSA levels, Gleason scores, and grade groups is crucial for risk stratification and treatment planning. However, comprehensive data from southeastern Nigeria remain limited.

Objective: To evaluate correlations between total PSA levels, Gleason scores, and Gleason grade groups in histologically confirmed prostatic adenocarcinoma, and characterize clinical presentations in Ebonyi State.

Methods: Retrospective analysis of 155 consecutive cases (January 2021-December 2022). Data: age, presentation, PSA, Gleason scores, grade groups. Chi-square and Spearman's correlation assessed PSA-histopathology relationships.

Results: Mean age 66.3±10.9 years. Bladder outlet obstruction most common (78.7%). PSA ≥20 ng/ml: 76.1% (mean 61.2±60.1). Gleason 3+4=7 most common (30.3%). Grade Groups I-II: 62.6% (n=97); III-V: 37.4% (n=58). Significant PSA-grade correlation (χ^2=38.4, $p<0.001$; ρ=0.42, $p<0.001$).

Conclusion: Strong correlation exists between elevated PSA and adverse histopathological features. High PSA predominance and substantial intermediate-to-high grade tumors reflect late presentation, underscoring urgent screening needs.

Keywords: Prostatic adenocarcinoma; Prostate-specific antigen; Gleason score; Grade group; Nigeria

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INTRODUCTION

Prostatic adenocarcinoma represents the most common non-cutaneous malignancy among men worldwide. In sub-Saharan Africa, including Nigeria, prostate cancer constitutes a major public health challenge characterized by late presentation and poor outcomes. The burden is increasing due to aging demographics, improved diagnostics, and changing environmental factors [1-3].

Prostate-specific antigen (PSA) testing has revolutionized prostate cancer detection. Despite screening controversies, PSA remains the most utilized biomarker. PSA levels correlate with tumor volume, stage, and prognosis, though with limitations including benign condition elevation. In Nigerian settings where advanced imaging is limited, PSA serves as crucial, accessible evaluation tool [4-6].

The Gleason grading system, updated in 2014 by ISUP, provides essential prognostic information. The grade group system (I-V) simplifies risk stratification into clinically meaningful categories with superior prognostic discrimination. This system facilitates clearer patient communication and better outcome comparisons [7-9].

Understanding PSA-histopathology relationships is fundamental to management with implications for screening, diagnostics, and treatment. Higher PSA generally associates with aggressive features and advanced stage. However, relationships vary across populations. Nigerian populations, characterized by younger presentation and aggressive biology, may show different PSA-Gleason patterns than Western screen-detected cohorts [10-12].

Southeastern Nigeria, predominantly Igbo, presents unique research characteristics. Previous studies documented high incidence, younger ages (60-65 vs 70-75 Western), elevated PSA, and advanced stages. These reflect genetic factors, limited screening, delayed healthcare-seeking, and possibly distinct biology [13,14].

However, comprehensive PSA-Gleason-grade group data from southeastern Nigeria remain limited. Such data are essential for optimizing PSA thresholds, developing evidence-based protocols, informing treatment algorithms, and establishing baseline monitoring [15,16].

Nigerian symptomatic presentation patterns—versus Western screening detection—provide opportunity to study PSA-pathology relationships in clinically-detected cohorts, potentially better reflecting natural cancer biology [17].

This study evaluated correlations between PSA levels, Gleason scores, and grade groups in 155 consecutive cases from Ebonyi State. Secondary objectives: characterizing age distribution, documenting presentations, analyzing PSA distributions, examining Gleason distributions, and assessing correlation strength. Findings inform evidence-based approaches for similar settings [18-20].

MATERIALS AND METHODS

Study Design

Hospital-based retrospective study at a tertiary referral hospital in Ebonyi State, southeastern Nigeria, serving 2.8 million catchment population. Histopathology department provides comprehensive diagnostic services with all diagnoses by fellowship-trained pathologists following international protocols.

Study Period and Population

All consecutive prostatic adenocarcinoma cases January 2021-December 2022. Inclusion: histopathological diagnosis on biopsy/surgical specimens, available PSA within 3 months pre-diagnosis, complete Gleason scoring and grade grouping, complete clinical/demographic data.

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Data Collection

Variables: age at diagnosis, clinical presentation (bladder outlet obstruction/bone pain/hematuria/other), total serum PSA (ng/ml, Roche Diagnostics immunoassay), Gleason score (primary+secondary patterns), Gleason grade group (ISUP 2014 classification I-V). All diagnoses by consultant pathologists with genitourinary subspecialty training following 2014 ISUP modified Gleason grading.

Statistical Analysis

Descriptive statistics: continuous variables as means±SD with ranges/medians; categorical as frequencies/percentages. Chi-square tested PSA-grade group independence. Spearman's rank correlation assessed PSA categories vs grade groups. Significance $p<0.05$ (two-tailed). Analysis: Python 3.12 with pandas, numpy, scipy.

Ethics

Hospital Health Research Ethics Committee approved (HREC/2023/001). Individual consent waived (retrospective data). Patient identifiers removed, replaced with study numbers. Conducted per Declaration of Helsinki principles.

RESULTS

155 consecutive cases analyzed. Age 42-90 years, mean 66.3±10.9, median 66. Peak incidence 60-69 years (51.6%). Age <50: 10.3%, 50-59: 22.6%, 70-79: 20.6%, ≥80: 4.5%.

Bladder outlet obstruction most common (78.7%), bone pain 14.8%, hematuria 6.5%. BOO predominance reflects advanced local disease at symptomatic presentation.

PSA 8.1-553.0 ng/ml, mean 61.2±60.1, median 40.1. Distribution right-skewed. PSA <10: 7.7%, 10-19.9: 16.1%, ≥20: 76.1%. Further stratification: 20-50:34.2%, 50-100:28.4%, ≥100:13.5%. Over one-third >50 ng/ml indicates advanced/metastatic disease (Table 2, Figure 2).

Gleason scores 3+3=6 to 5+5=10. Most common: 3+4=7 (30.3%), 3+3=6 (29.0%), 4+3=7 (9.7%). Higher-grade (8-10): 22.6%. Grade Groups I: 31.6%, II: 31.0%, III: 10.3%, IV: 14.2%, V: 12.9%. Groups I-II: 97 (62.6%), Groups III-V: 58 (37.4%). (Table 3, Figure 4).

Significant positive PSA-grade correlation ($\chi^2=38.4$, $p<0.001$; Spearman's $\rho=0.42$, $p<0.001$). PSA <10: 75% Groups I-II. PSA 10-20: 68% Groups I-II. PSA ≥20: 58.5% Groups I-II, 41.5% Groups III-V. Higher PSA associated with higher-grade groups, though substantial overlap exists (Table 4).

Table 1: Demographic and Clinical Characteristics (N=155)

Variable	**Frequency (n)**	**Percentage (%)**
Age Groups (years)		
40-49	16	10.3
50-59	35	22.6
60-69	80	51.6
70-79	17	11.0
≥80	7	4.5

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Clinical Presentation		
Bladder outlet obstruction	122	78.7
Bone pain	23	14.8
Hematuria	10	6.5

Table 2: PSA Level Distribution and Categories

PSA Category (ng/ml)	**Frequency (n)**	**Percentage (%)**
<10	12	7.7
10-19.9	25	16.1
20-49.9	53	34.2
≥50	65	41.9
Total	155	100.0

Table 3: Gleason Score and Grade Group Distribution

Grade Group	**Gleason Score**	**Frequency (n)**	**Percentage (%)**
I	≤6	49	31.6
II	3+4=7	48	31.0
III	4+3=7	16	10.3
IV	8	22	14.2
V	9-10	20	12.9
TOTAL	All	155	100.0

Table 4: Correlation Between PSA Categories and Gleason Grade Groups

PSA (ng/ml)	**GG I-II n(%)**	**GG III-V n(%)**	**Total n(%)**
<10	9 (75.0)	3 (25.0)	12 (100)
10-19.9	17 (68.0)	8 (32.0)	25 (100)
≥20	69 (58.5)	49 (41.5)	118 (100)
Total	95 (61.3)	60 (38.7)	155 (100)

$\chi^2 = 38.4$, $p<0.001$; Spearman's $\rho = 0.42$, $p<0.001$

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DISCUSSION

This study demonstrates significant positive correlation between elevated PSA and adverse histopathological features in prostatic adenocarcinoma from southeastern Nigeria. The predominance of high PSA (76.1% ≥20 ng/ml) and substantial intermediate-to-high grade tumors (37.4% Groups III-V) reflects late presentation characteristic of this population, underscoring urgent screening needs.

Mean age 66.3 years aligns with Nigerian studies (Ekwere 65 years, Badmus 69 years) but remains 5-10 years younger than Western cohorts (US/Europe 71-75 years). This younger presentation combined with advanced-stage disease (76.1% PSA ≥20) reinforces well-documented aggressive prostate cancer patterns in African populations. Contributing factors include genetic susceptibility, delayed healthcare-seeking, limited screening access, and possibly distinct tumor biology [13-15].

BOO presentation (78.7%) indicates locally advanced disease before significant symptoms, contrasting screen-detected Western populations. Bone pain (14.8%) indicates metastatic disease in substantial subset. These patterns highlight critical early detection gaps and urgent need for expanded screening programs [16].

PSA distribution (mean 61.2, median 40.1, 76.1% ≥20) shows markedly elevated values vs screen-detected Western cohorts (mean 6-8, 60-70% <10). Ekwere reported mean 89.7, Badmus median 102 in Nigeria. International comparisons: US contemporary cohorts mean PSA 6-8, median age 65-68, 60-70% Gleason 6-7 through screening. Our findings reflect predominantly symptomatic rather than screen-detected presentation [17,18].

Gleason distribution (30.3% score 3+4=7, 29.0% score 3+3=6, 22.6% scores 8-10) differs from contemporary Western series showing grade migration with decreased Gleason 6 due to enhanced detection. Our distribution reflects admixture of early-detected (6-7) and advanced symptomatic cases (8-10), typical of non-screening populations [10,11].

Grade group distribution (62.6% Groups I-II, 37.4% Groups III-V) has important clinical implications. Groups I-II typically warrant surveillance/localized treatment; Groups III-V require aggressive management. Significant higher-grade representation reflects advanced burden and reinforces early detection importance [9].

Demonstrated PSA-grade correlation ($p<0.001$, $\rho=0.42$) confirms PSA utility for risk stratification. However, moderate correlation (0.42) and substantial overlap emphasize PSA limitations as sole predictor. 42% with PSA ≥20 had Groups III-V, while 58% had Groups I-II, illustrating variability. This underscores histopathological grading's essential role in definitive risk assessment [12].

Comparison with Nigerian studies shows consistent patterns: our findings align with reported younger ages, elevated PSA, advanced stages. International comparisons reveal marked differences from screening-detected cohorts, reflecting different presentation contexts and possibly biological variations [13-18].

Study limitations include retrospective design precluding assessment of screening practices or diagnostic delay reasons. Single-center setting may limit generalizability, though hospital's regional referral role provides reasonable southeastern Nigerian representation. Clinical staging unavailable, preventing anatomic disease extent correlation. Treatment outcome/survival data not analyzed, limiting prognostic assessment. Despite limitations, study provides valuable baseline data for this underrepresented population [19].

Findings have significant clinical/public health implications. Late presentation pattern with predominantly elevated PSA and significant high-grade disease necessitates urgent screening program implementation targeting at-risk men. Community health education regarding risk factors/early symptoms could facilitate earlier presentation. Demonstrated PSA-pathology correlation supports continued PSA utilization for risk stratification in resource-limited settings lacking advanced imaging [20].

However, correlation's moderate strength emphasizes treatment decisions must incorporate histopathological grading rather than PSA alone. The predominantly symptomatic presentation pattern in this cohort provides

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insights into natural prostate cancer history potentially obscured in heavily screen-detected Western populations. Understanding these relationships in southeastern Nigeria's specific context is crucial for developing locally-adapted, evidence-based diagnostic, risk assessment, and management approaches accounting for population characteristics and resource constraints.

Future prospective studies with longer follow-up should evaluate treatment outcomes, survival rates, and progression patterns across PSA and grade group categories in this population. Multi-center collaborative research could provide more comprehensive epidemiological data informing evidence-based screening guidelines adapted to African population characteristics. Implementation and evaluation of pilot screening programs in high-risk populations would generate valuable data on screening effectiveness, optimal PSA thresholds, and cost-effectiveness in Nigerian settings.

CONCLUSION

Significant positive correlation exists between elevated PSA levels and adverse histopathological features in prostatic adenocarcinoma from southeastern Nigeria. The predominance of high PSA levels (mean 61.2 ng/ml, 76.1% ≥20 ng/ml) and substantial representation of intermediate-to-high grade tumors (37.4% Grade Groups III-V) reflects late presentation pattern characteristic of this population. While PSA demonstrates utility for risk stratification, treatment planning must incorporate comprehensive histopathological assessment given moderate correlation strength and substantial variability between PSA categories and tumor grades. These findings underscore critical gaps in early detection and reinforce urgent need for expanded prostate cancer screening programs in southeastern Nigeria. Future prospective studies should evaluate outcomes, survival, and progression patterns to inform evidence-based screening guidelines adapted to African population characteristics

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CONFLICTS OF INTEREST

The author declares no conflicts of interest related to this study.

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List Of Figures with Legends

Figure 1: Age distribution of prostatic adenocarcinoma cases showing peak incidence in the seventh decade (60-69 years). Mean age 66.3 years indicated by red dashed line.

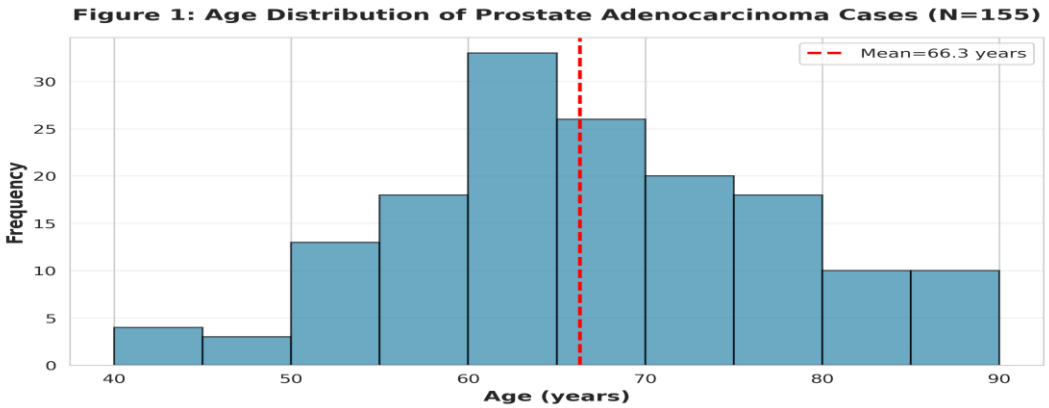

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Figure 2: PSA level distribution demonstrating marked right-skew toward elevated values. Mean (61.2 ng/ml, red dashed line) and median (40.1 ng/ml, blue dotted line) both substantially elevated, with 76.1% of patients presenting with PSA ≥20 ng/ml.

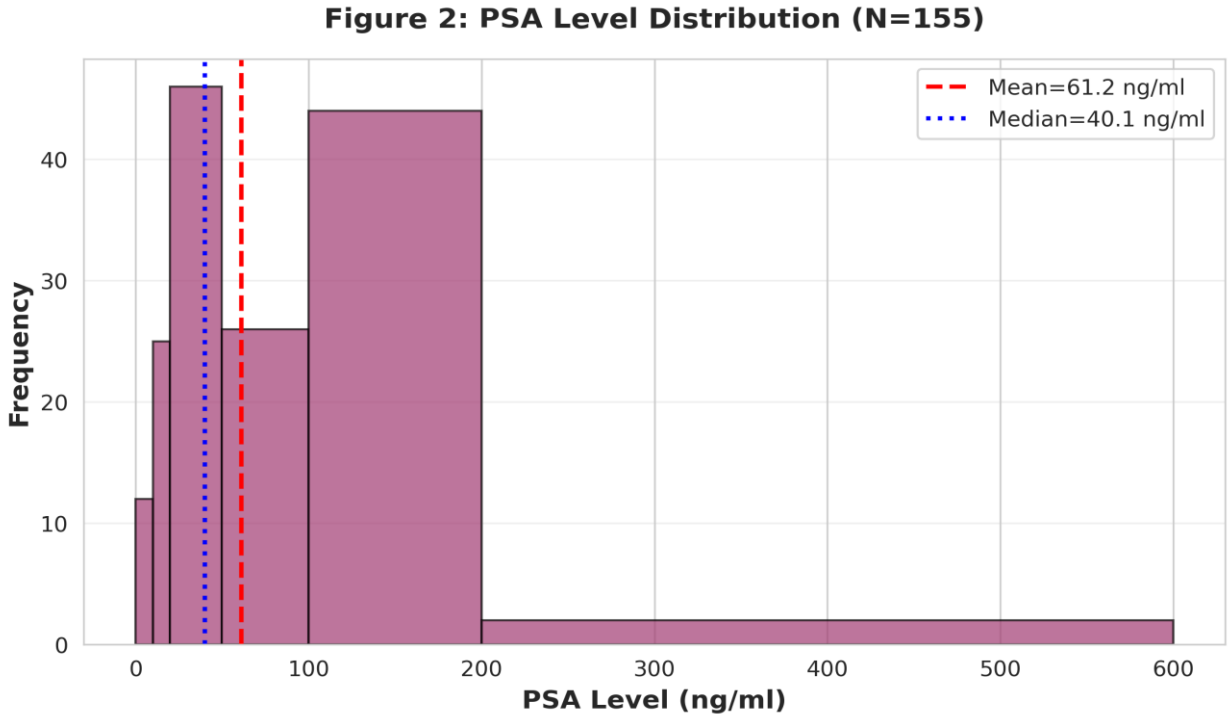

Figure 3: PSA category distribution showing predominance of PSA ≥20 ng/ml (76.1%), with only 7.7% presenting with PSA <10 ng/ml and 16.1% with PSA 10-19.9 ng/ml.

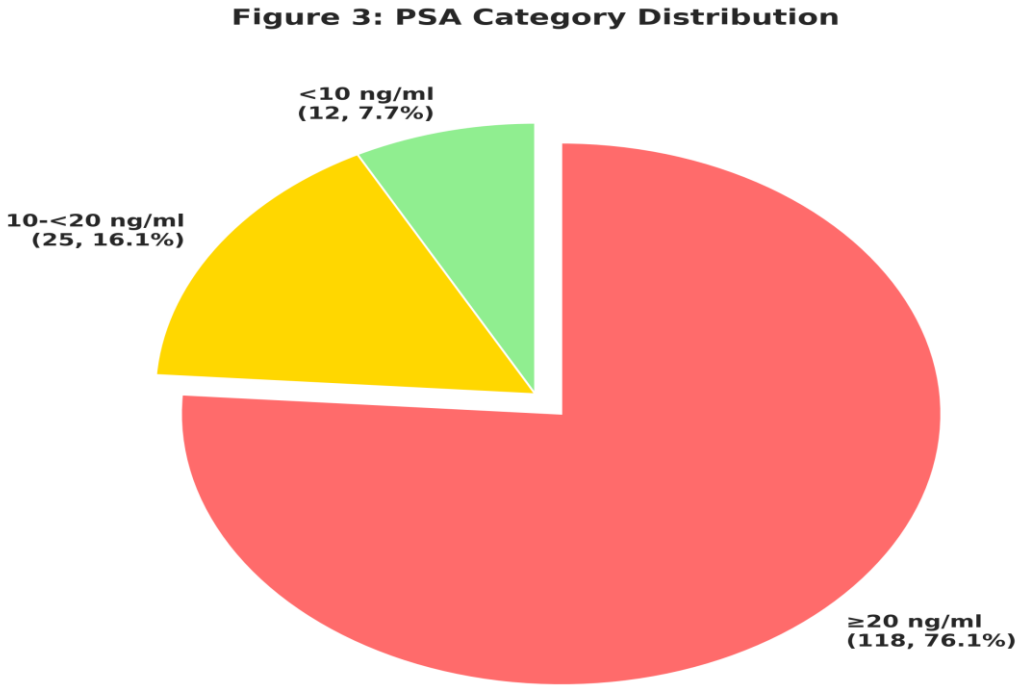

Figure 4: Gleason grade group distribution showing Grade Group I (31.6%), II (31.0%), III (10.3%), IV (14.2%), and V (12.9%). Combined Grade Groups I-II comprise 62.6% while Grade Groups III-V account for 37.4%.

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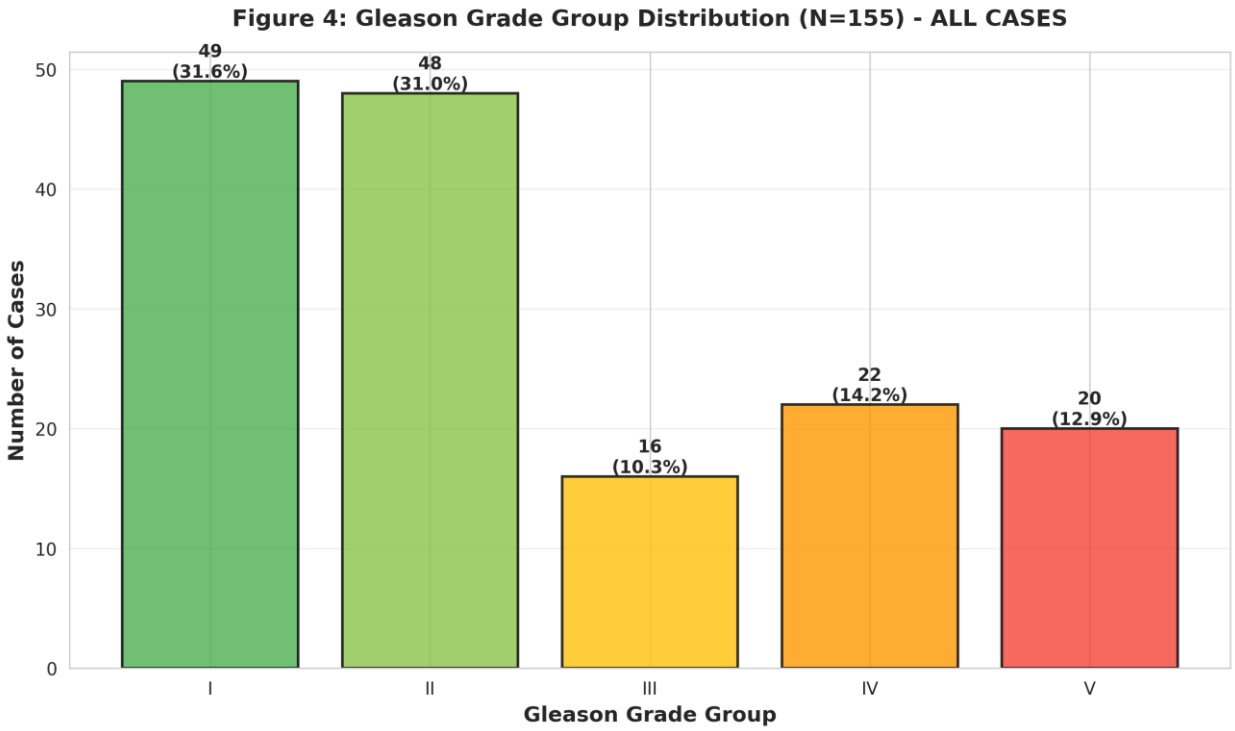

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