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Using Prostate-specific Antigen to Predict Gleason Scores in African Men Seeking Urological Services at a Referral Hospital in Kisumu, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Men are more likely to develop prostate lesions like benign prostatic hypertrophy and prostate cancer as they age. Prostate specific antigen (PSA), which is secreted in large quantities above normal levels of 0–4 ng/ml by cells of the prostate gland in benign prostate hypertrophy (BPH) or prostate cancer (Pca), is a biological marker for the diagnosis of prostate cancer; hence, early diagnosis using PSA facilitates disease detection; the higher the level of PSA, the higher the chance of having prostate cancer (Negahdary et al., 2020; Zhang & Sun, 2018). The Gleason scale is used to grade patients with prostate cancer and determine their risk of the disease progressing. Is it possible to predict the Gleason scores of people with prostate cancer based on their PSA

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levels? The primary goal of the current study was to establish a correlation between the patient's PSA level and the associated Gleason scores at the time of prostate biopsy at Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH).

Methods: The study utilized a cross-sectional retrospective that focused on patient reports with prostate histology who had a PSA between 2017 and 2022 when they requested a biopsy. The majority of the examined histology reports that did not include a PSA level and thus were disregarded. There were 80 sample reports as a result of this exclusion.

Results: According to the study, 36 (45%) of the patients whose prostate tissues were examined had prostate cancer. The majority of 24 (66.7%) patients who had PSA values more than 50 ng/ml when they were first diagnosed with prostate cancer were classified as Gleason 7/Group 2 or higher. The study sought to determine whether PSA levels and Gleason scores were correlated. Gleason scores and PSA levels have a statistically significant positive correlation ($p = 0.004$, $r = 0.474$). The majority of patients, 55 (65%), who had high PSA values (>4 ng/ml), were between the ages of 60 and 79. These patients were followed by those who were >80 years old at 15 (18.75%) and those who were 50 to 59 years old at 10 (10%). Age and PSA levels were shown to have a statistically significant positive Pearson correlation ($r = 0.236$, $p = 0.035$, 95% CI).

Conclusions: Gleason scores rise with increasing PSA levels. Age and PSA level have a positive correlation.

Keywords: Prostate specific antigen; prostate specimens; prostate cancer; Gleason score.

1. INTRODUCTION

1.1 Background

The prostate gland is thought to be vulnerable to age-related diseases such cancer and benign prostatic hyperplasia (BPH). Among the aging male population, benign prostate enlargement and prostate cancer are prevalent issues that call for urological care. After skin cancer, prostate cancer is the second most prevalent cancer diagnosis among males. Prostate cancer is the fifth most common cause of death worldwide and can have a slow, asymptomatic early course [1]. Urinary tract symptoms and increased PSA values (>10ng/mL) are used to make the diagnosis of prostate cancer. A biopsy is then required to confirm the diagnosis through histological characterization. The extraprostatic extension and seminal vesicle invasion that characterize intraductal prostate cancer, which affects the prostate ducts and/or acini, are frequently accompanied by a high Gleason score, a considerable tumor volume, and unfavorable prognostic indicators. Atypical cribriform prostate tumors known as intraductal carcinoma are related with higher Gleason scores and worse outcomes [2]. Correlating a patient's PSA level and Gleason scores at the time of a prostate biopsy at Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH) was the primary goal of this study. Can we predict the Gleason scores based on PSA level in patients diagnosed with prostate cancer?

2. METHODOLOGY

2.1 Study Design

This study used a cross-sectional retrospective methodology and included prostate specimen histology reported between 2018 and 2022 in a pathology laboratory. It was a cross-sectional retrospective investigation. The study focused on patient reports with prostate histology who had a PSA between 2017 and 2022 when they requested a biopsy. The majority of the examined histology reports that did not include a PSA level were excluded. There were 80 sample reports as a result of exclusion.

2.2 Data Collection

The research was carried out December 2, 2022 to March 30 2023. With the assistance of two research assistants who were laboratory technicians employed by the hospital's pathology department and knowledgeable about obtaining soft copy data from the storage location, the researcher was able to collect the data from the lab. The age, clinical and PSA values, and Gleason scores were then extracted from each prostate pathology report into each data extraction form for each patient profile.

2.3 Data Analysis

With SPSS version 29 for Windows, descriptive and inferential statistics were performed. The age and prostate-specific values were correlated

using Pearson correlation analysis. The association between Gleason's scores and PSA levels was achieved using Pearson correlation statistics. A statistically significant result was defined as a p value of less than 0.05.

3. RESULTS

According to the study, 36 (45%) of the participants whose prostate tissues were examined had prostate cancer. The majority of 24 (66.7%) patients who had PSA values more than 50 ng/ml when they were first diagnosed with prostate cancer were classified as Gleason 7/Group 2 or higher. The purpose of the study was to determine whether Gleason scores and PSA levels are correlated (Table 1).

The association between Gleason's scores and PSA levels was done using Pearson's correlation statistics. The study found that Gleason scores and PSA levels had a statistically significant positive connection (p = 0.004, r = 0.474) (Table 2). As a result, the null hypothesis was not accepted.

The majority of the patients who had high PSA values (>4 ng/ml), 55 (65%) were between the ages of 60 and 79; the next age groups were >80 years at 15 (18.75%) and 50 to 59 years at 10 (10%) (Fig. 1). There were no patients in the 40–49 age group with high PSA. Patients with high PSAs typically presented between the ages of 60 and 79.

A statistically significant positive correlation (r = 0.236, p = 0.035, 95% CI) was demonstrated between age and PSA values (Table 1). Alternate hypothesis was therefore supported. This indicates that increasing age would raise PSA levels, and that men over 60 who may have higher Gleason scores are more likely to have high PSA levels and a positive histology report for prostate cancer.

Table 1. Gleason scores, PSA crosstabulation

		PSA (ng/ml)					Total
		0-4	5-10	11-49	50-99	>100	
Gleason Scores	Gleason<6/Group 1	0	2	3	2	1	8
		0.0%	66.7%	60.0%	33.3%	4.8%	22.2%
	Gleason 7/Group 2	1	0	1	1	6	9
		100.0%	0.0%	20.0%	16.7%	28.6%	25.0%
	Gleason 7/Group 3	0	1	1	1	5	8
		0.0%	33.3%	20.0%	16.7%	23.8%	22.2%
	Gleason 8/Group 4	0	0	0	2	4	6
		0.0%	0.0%	0.0%	33.3%	19.0%	16.7%
	Gleason 9or10/Group 5	0	0	0	0	5	5
		0.0%	0.0%	0.0%	0.0%	23.8%	13.9%
Total		1	3	5	6	21	36
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 2. Pearson PSA and Gleason scores correlation

Correlations			
		PSA (ng/ml)	Gleason Scores
PSA (ng/ml)	Pearson Correlation	1	.474**
	Sig. (2-tailed)		.004
	N	80	36
Gleason Scores	Pearson Correlation	.474**	1
	Sig. (2-tailed)	.004	
	N	36	36

***. Correlation is significant at the 0.01 level (2-tailed)*

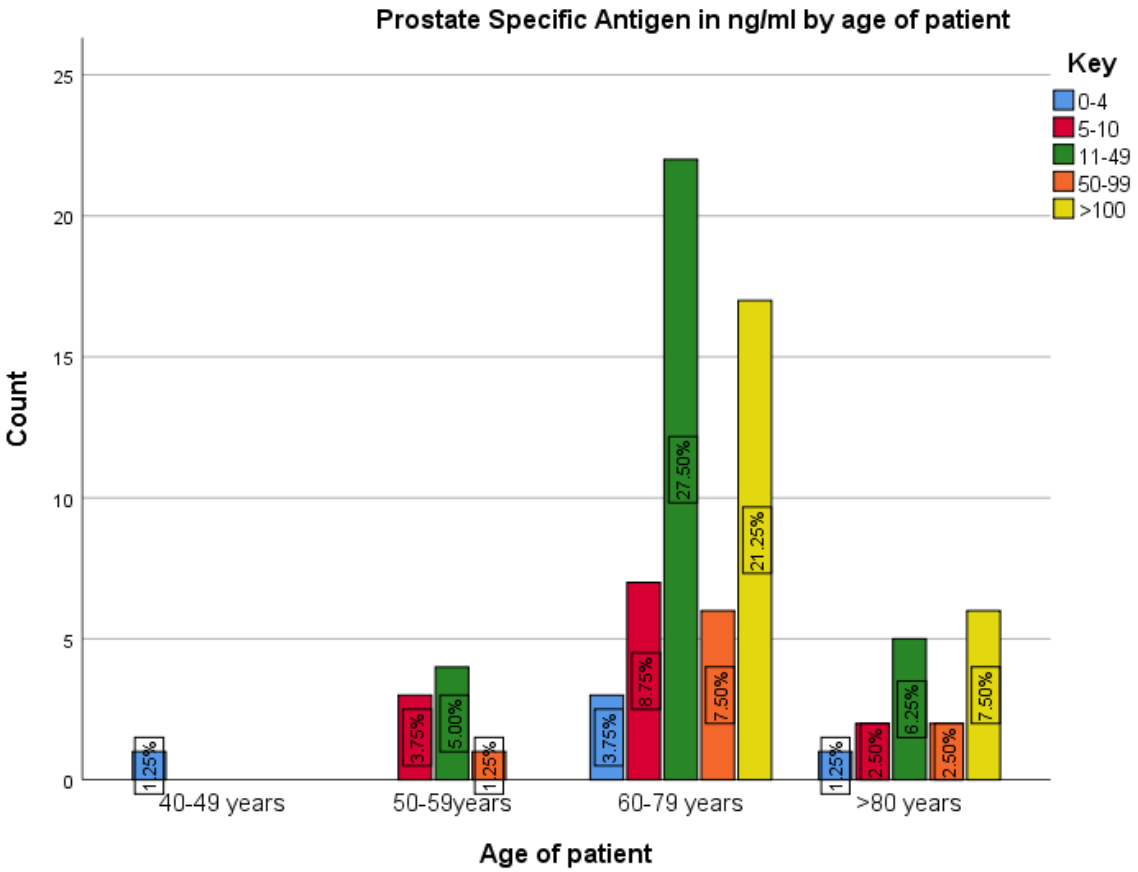

Fig. 1. Prostate Specific Antigen levels by age

Table 3. Patient age and PSA pearson correlation

Correlations			
		PSA (ng/ml)	**Age of patient**
PSA (ng/ml)	Pearson Correlation	1	.236*
	Sig. (2-tailed)		.035
	N	80	80
Age of patient	Pearson Correlation	.236*	1
	Sig. (2-tailed)	.035	
	N	80	80

**. Correlation is significant at the 0.05 level (2-tailed)*

4. DISCUSSION

Gleason scores and PSA levels were shown to be statistically significantly correlated in the current investigation (p = 0.004, r = 0.474) (Table 2). The current study's findings concur with those of Cihan et al. [3], who found a strong and positive correlation between patients' age and PSA levels and their ISUP grade (based on Gleason scores). Though the results are consistent, it should be highlighted that Cihan et al. [3] conducted a prospective study, and their reporting was probably more accurate than that of a retrospective investigation. In a similar vein, [4] discovered that in a prospective analysis of patients who had radical prostatectomy, Gleason scores strongly correlated with PSA levels. However, the current results contradict the conclusions drawn by Sanli et al [5]. This might be because [5] concentrated on patients who were receiving therapeutic follow-up; as a result, the relationship might have been complicated by the treatment.

According to the present study's findings, PSA levels increase with age, and men 60 years of

age and older were probably going to have higher PSA levels, which might range from 11 ng/ml to more than 100 ng/ml. The results of the present investigation are consistent with the findings of Liu et al. [6] and Maciel et al. [7], who discovered that PSA levels begin to increase at 58 years of age, in contrast to Cihan et al. [3], who discovered that the median age at which PSA levels begin to increase is 63 years of age. The findings of the current study align with [8,9], which claims that 30% of people with high PSA test positive for prostate cancer (compared to the current 36%–45%). The age disparities observed in various studies [3,6,7] at the period when PSA levels began to rise could suggest that race has a significant influence on male PSA levels in connection to prostate pathology.

While the results of this study are consistent with those of [3,8,9], it is crucial to remember that Cihan et al. [3] conducted a prospective descriptive study wherein complaints of reduced urinary tract symptoms and elevated PSA between July 2019 and December 2019 led to a decision to have a prostate biopsy. Nonetheless, these results are not consistent with those of [10], who discovered that a small number of patients with low PSA levels (0–4 ng/dL) had positive prostate cancer tests. These results may indicate that low PSA levels are found in people with advanced prostate disease when the prostate's function is compromised.

According to the results of the current study, 36 people (45%) who had a high PSA also had positive prostate cancer tests. These results concur with those of Zhang and Sun [11], which may indicate that age is a factor in PSA levels, and that men over 60 who test positive for prostate cancer on a prostate biopsy are more likely to have high PSA levels. The results of this investigation are consistent with those of Maciel et al. [7], who discovered a strong correlation ($p = 0.008$) between free PSA and total PSA in the age ranges of 60–69 and 70–80. The results of the current study are consistent with those of previous studies [7,12,11], suggesting that PSA may be a significant variable that positively changes with age. An alternative explanation could be that other research, with the exception of differences in the study population, also used retrospective cross-sectional studies that are comparable to the current study.

Overall, the study's results point to a positive association between age and PSA ($r = 0.283$), with higher PSA levels likely to be seen in men 60 years of age and older who may be suffering from benign prostatic hyperplasia or prostate cancer, respectively. The results of this investigation, along with those of other studies [8,13,12,14,11], suggest that routine prostate evaluation may be beneficial for guys over 60 who exhibit urinary symptoms in order to identify prostate lesions in a timely manner. It should be remembered that, in contrast to prospective investigations like those by [8], the current study was a retrospective analysis that solely examined reports related to prostates. Therefore, more investigation is required to ascertain the extent of prostate lesions in patients exhibiting increased PSA levels at presentation.

5. CONCLUSIONS

Gleason scores are positively correlated with higher PSA levels ($p = 0.004$, $r = 0.474$). Males 60 years of age and older who may have benign prostate hyperplasia or prostate cancer are likely to have higher PSA values, depending on which condition occurs first. In order to identify prostate lesions in men between the ages of 50 and 59 who exhibit symptoms related to their urine, the research also suggests that routine prostate evaluations may be beneficial. Remember that this was a retrospective analysis, looking exclusively at reports related to prostate cancer. Therefore, more investigation is required to ascertain the stage (or extent) of prostate lesions in individuals with prostate cancer who exhibit elevated PSA levels upon presentation.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that Quillbot application was used in paraphrasing and language check during manuscript writing.

CONSENT AND ETHICAL APPROVAL

The National Commission for Science, Innovation, and Technology granted a license for this study under license number NACOSTI/P/23/22845. This work was accepted by the Maseno University Board of Postgraduate Studies, with reference number MSC/SM/00009/020. The Jaramogi Oginga Odinga Teaching and Referral Hospital Ethics Committee accepted this study under reference number ISERC/JOOTRH/659/22. The hospital CEO gave permission for access data to be collected prior to the retrieval of prostate histopathology reports between January 2017 and December 2022. No patient identification were gathered during or after the trial since all records were anonymised prior to printing.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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