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Clinical Characteristics and Correlations of Prostate Pathologies with PSA Levels: A Retrospective Study at a Tertiary Hospital

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Abstract: Introduction: Despite diagnostic advances, prostate cancer is a major health concern among aging men. Few studies have been conducted in Palestine for the assessment of prostate pathologies. Thus, the present study aimed to investigate the clinical characteristics and correlation of prostate pathologies with PSA levels. **Methods:** This retrospective study, conducted at An-Najah National University Hospital, enrolled patients who underwent prostate biopsy between 2020 and 2022. The data collected included demographics, PSA levels, and histopathological reports. Statistical analyses were performed to explore associations between variables. **Results:** In 111 participants, prostate adenocarcinoma was the most prevalent histopathology (41%). The majority of patients came from the 61–80-year age group with mostly PSA levels ranging from 4.1 to 100 ng\ml. Gleason scores of 8 and 9 were the highest in number. Weak correlations between age, PSA level, and Gleason score were noted. **Conclusion**: This study provides insights into the clinical profile of prostate cancer patients within the Palestinian population. There is a need for further research to improve diagnostic approaches and personalized management strategies to optimize patient care and outcomes.

Keywords: Prostate cancer, PSA, Histopathology, Gleason Score, Screening.

Introduction

Prostate cancer is the second most commonly diagnosed cancer and the fifth leading cause of cancer-related deaths in men worldwide [1]. It is expected that 1 in every 8 men will develop prostate cancer at some point in their lifetime [2]. The risk of developing prostate cancer increases with age, with more than 60% of cases diagnosed after 65 years of age [3]. Several risk factors have been linked to prostate cancer, including family history, race, hereditary syndromes, metabolic syndrome, obesity, and smoking [3, 4]. Lower urinary tract symptoms, "LUTS," can be caused by prostate enlargement or prostate cancer, and LUTS have been studied in different cohorts of patients but not patients with prostate cancer [5-12].

The diagnosis of prostate cancer involves several diagnostic modalities, including multiparametric magnetic resonance imaging (mpMRI), prostate-specific antigen (PSA), transrectal ultrasound (TRUS)-guided prostate biopsy, transperineally ultrasound-guided prostate biopsy, and other genomic testing [13]. According to the current evidence, mpMRI is recommended for use prior to prostate biopsy and can guide subsequent decision-making [14]. Despite clinical advancements, digital rectal examination is still valuable for patients with suspected prostate cancer [15].

PSA, a serine protease, is considered an essential diagnostic and management biomarker in prostate cancer [16]. Several other urine and blood markers have also been utilized in the diagnosis and risk stratification of prostate cancer patients [4]. Many conditions can lead to an increase in serum PSA, such as prostatitis, prostate surgery, and benign prostate hyperplasia, and this has led to the belief that PSA is not cancer-specific but rather organ-specific [17].

Screening for prostate cancer is still controversial, with several guidelines recommending screening at approximately 50 years of age but at the expense of overdiagnosis [18, 19].

Limited data are available regarding the prevalence of prostate cancer among the Palestinian population, with one study showing an incidence rate of 4.5 per 100000 cases [20]. Moreover, prostate cancer is the second leading cause of cancer deaths among the Palestinian population [21]. The present study aimed to describe the clinical characteristics of prostate cancer patients and to correlate different histopathological diagnoses with PSA levels.

Methods

Study design, settings, and study population

A retrospective descriptive study was conducted at An-Najah National University Hospital (NNUH). The study population consisted of all of the patients who underwent prostate biopsy during the years 2020, 2021, and 2022 at NNUH. The inclusion criterion was men who underwent prostate biopsy at NNUH during the years, as mentioned earlier, while the exclusion criterion was patients who were reported to have other malignancies or patients who had missing files or results. The patients included in our study were referred for biopsy based on elevated PSA levels, abnormal digital rectal examination findings, or other clinical indications suggestive of prostate pathology. We also noted that symptoms varied among patients and were not uniformly documented across all records, which may have limited our ability to capture symptomatic presentation upon referral fully.

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Data collection

The data were collected from the patient's files and records and prostate biopsy reports. The collected data included age, weight, height, body mass index (BMI), presence of diabetes mellitus (DM), presence of hypertension (HTN), prostate-specific antigen (PSA), and Gleason score. All patients had a PSA result obtained on the day of the procedure or within 1 week prior to the procedure. Pathology reports were reviewed, and results were obtained, including the Gleason score. Pathology results were grouped into either benign or malignant (prostate adenocarcinoma).

Gleason Score

The Gleason Score is a grading system that assesses prostate cancer aggressiveness based on the histological patterns of tumor cells observed in a biopsy. The score is calculated by summing the grades of the two most predominant histological patterns observed in the tumor, each graded on a scale of 1 to 5. Scores range from 6 (low-grade) to 10 (high-grade), with higher scores indicating more aggressive disease [22].

Statistical analysis

The data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 21. The data are expressed as the means ± standard deviations (SD) for continuous variables and as frequencies and percentages for categorical variables. Variables not normally distributed were expressed as medians (lower-upper quartiles). Variables were tested for normality using the Kolmogorov–Smirnov test. Either the chi-square test or Fisher's exact test, as appropriate, was used to test for significant differences between categorical variables. The Kruskal–Wallis test, followed by Bonferroni–Dunn post hoc analysis or the Mann–Whitney test, were used to determine the differences in the means between categories. The significance level was set at a p-value < 0.05.

Ethical approval

All aspects of the study protocol, including access to and use of patient clinical information, were authorized by the Institutional Review Boards (IRBs) of An-Najah National University "ANU" and NNUH and the local health authorities. The information was confidential and was used for research purposes only.

Results

Participant characteristics

One hundred fourteen reports were initially reported from systems in which PSA analysis was performed within the last three years at NNUH. Three of these were excluded because most of their data were missing. The final analysis included 111 reports of patients and their PSA levels and pathology reports. The mean age of the participants was 68 years. Most patients were between 61 and 70 (42.3%), followed by those aged 71-80 (29.7%). Only one patient was in the 91-100 years age group. Almost 21% and 50% of participants at the time of PSA analysis had diabetes mellitus and hypertension, respectively.

Pathology report

The most common pathology reported was prostate adenocarcinoma (41% of participants). The second most common type was benign prostatic tissue (31.4%), followed by benign prostatic hyperplasia (27.6%) (Table 1).

Table (1): Distribution of Prostate Pathologies in Biopsy Samples.

Pathology report	Frequency (%), N=105
Benign Prostatic Hyperplasia	29 (27.6%)
Benign Prostatic Tissue	33 (31.4%)
Prostate Adenocarcinoma	43 (41.0%)

Most patients with prostate adenocarcinoma were between 71 and 80 years of age (37.2%), while 32.6% of them were between 61 and 70 years of age. On the other hand, approximately 50% of those with benign prostatic hyperplasia were in the 61-70 years age group. (Table 2). Additionally, 25% of patients whose prostate tissue was benign were between 51 and 60 years of age, and 56.3% of them were between 61 and 70 years of age. Among patients diagnosed with prostate adenocarcinoma, the most common Gleason score reported in the histopathology exam was 9 (35%), followed by 8 (30%). Only three patients had a Gleason score 10 (7.5%) (Table 3).

Table (2): Correlations between Age Category and Prostate Pathology in Biopsy Samples.

Age	Benign Prostatic Hyperplasia Frequency (%), N=29	Benign Prostatic Tissue, Frequency (%), N=33	Prostate Adenocarcinoma, Frequency (%), N=43	P value
51-60	4 (13.8)	8 (25.0)	9 (20.9)	
61-70	14 (48.3)	18 (56.3)	14 (32.6)	
71-80	7 (24.1)	6 (18.8)	16 (37.2)	0.169
81-90	3 (10.3)	0 (0.0)	4 (9.3)	
91-100	1 (3.4)	0 (0.0)	0 (0.0)	

Table (3): Distribution of Prostate Pathologies by Gleason Score.

Gleason score	Frequency (%), N=40
6	5 (12.5)
7	6 (15.0)
8	12 (30.0)
9	14 (35.0)
10	3 (7.5)

PSA levels

Most patients had a PSA level between 4.1 and 20 ng/mL (42.3%). The PSA level ranged from 20.1-100 ng/mL (30.9%). Very few patients (10.3%) had a PSA level greater than 100 ng/mL (10 patients), and 14 patients did not have a recorded PSA level (Table 4). Patients with a PSA level greater than 100 ng/mL were mostly between 61 and 70 years old (four patients). In this most common age category (61-70 years), most PSA levels were between 2.1-100 (Table 5).

Table (4): Distribution of PSA Levels in Prostate Pathology Patients.

PSA level	Frequency (%), N=97
Less than 4	16 (16.5%)
4.1-20	41 (42.3%)
20.1-100	30 (30.9%)
More than 100	10 (10.3%)

Table (5): Correlations between Age and PSA Levels in Prostate Pathology Patients.

Age	Less than 4	4.1-20	20.1-100	>100	P value
51-60	4 (26.7)	10 (24.4)	4 (13.3)	2 (20.0)	
61-70	5 (33.3)	20 (48.8)	13 (43.3)	4 (40.0)	
71-80	6 (40.0)	7 (17.1)	12 (40.0)	2 (20.0)	0.445
81-90	0 (0.0)	3 (7.3)	1 (3.3)	2 (20.0)	
91-100	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	

Most patients with prostate adenocarcinoma had a PSA level between 20.1 and 100 ng/mL (50.0%) (Table 6). Most patients with benign prostatic hyperplasia had PSA levels between 4.1 and 20 ng/mL (47.8%). This was the same for patients with benign prostatic tissue in their pathology report (63.3%).

Table (6): Association between PSA Levels and Prostate Pathologies: Benign Prostatic Tissue, Benign Prostatic Hyperplasia, and Prostate Adenocarcinoma.

PSA Level	Benign Prostatic Hyperplasia Frequency (%)	Benign Prostatic Tissue, Frequency (%)	Prostate Adenocarcinoma, Frequency (%)	Total
Less than 4	6 (20.0)	8 (34.8)	1 (2.6)	15 (16.5)
4.1-20	19 (63.3)	11 (47.8)	8 (21.1)	38 (41.8)
20.1-100	5 (16.7)	4 (17.4)	19 (50.0)	28 (30.8)
More than 100	0 (0.0)	0 (0.0)	10 (26.3)	10 (11.0)

Associations between PSA levels and risk factors

While no statistically significant associations were identified between PSA levels and the risk factors studied, there were correlations observed between PSA concentration and the number of cores, the percentage of cores involved (correlation coefficients of 0.25 and 0.144, respectively), and age (coefficient of 0.15) (Table 7).

Table (7): Correlations between PSA Levels, Clinical Parameters, and Pathological Findings.

	Age	Weight	Height	BMI	No. of Positive Cores	Percentage	Size US
PSA level Pearson correlation P value	 0.151 0.137	 -0.028 0.796	 -00.074 0.492	 -0.013 0.904	 0.250 0.183	 0.144 0.397	 -0.254 0.119
Gleason score Pearson correlation P value	 0.065 0.688	 0.103 0.539	 0.071 0.673	 0.103 0.538	 0.145 0.429	 0.205 0.217	 0.676 0.141

Associations between Gleason score and risk factors

The strongest correlation was between the Gleason score and prostate size in the US (coefficient = 0.68). This was followed by the percentage of cores involved and the number of cores (coefficient = 0.21 and 0.15, respectively). However, the Gleason score and age correlation were relatively weak (coefficient = 0.07). No statistically significant correlations were reported (Table 7).

Association between Gleason score and PSA level

The correlation between the PSA level and the Gleason score was relatively weak (coefficient = 0.01) and was not statistically significant. (p value = 0.95).

Discussion

In our retrospective study conducted at a tertiary hospital, we investigated the correlation between clinical characteristics, histological diagnosis, and PSA levels in patients who underwent TRUS-guided prostate biopsy. Prostate cancer poses a significant worldwide health concern due to diagnostic and therapeutic challenges [13]. Our research aimed to contribute additional insights to the literature by elucidating the clinical features of affected individuals and exploring the relationship between PSA levels and histopathological results. Our focus on the Palestinian community also enhanced our understanding of prostate cancer incidence and treatment options in our region.

The risk of prostate cancer increases with age, with a prevalence reaching 71% in individuals over 79 years of age [23]. This should be considered in addition to other risk factors that increase the risk of developing prostate cancer, such as black ethnicity, family history, and genetic mutations [4]. In our study, the mean age at histopathological diagnosis was 71-80 years, consistent with other studies' findings. Consequently, many worldwide organizations have adopted screening programs starting at 50 years old to aid in the early detection of prostate cancer and thus provide optimal follow-up and management strategies [18, 19, 23, 24].

In our study, the most commonly reported Gleason score was 9, followed by 8, which suggests an advanced and delayed diagnosis of prostate cancer in the Palestinian community. In addition, prostate cancer tends to be asymptomatic in the early stages of the disease and becomes more debilitating with advancing stages [19, 25]. This finding points to the importance of adopting a national screening program among the Palestinian community to aid in the early detection of prostate cancer and the prevention of devastating sequelae.

The majority of patients diagnosed with prostate adenocarcinoma in our study had PSA levels between 20.1 and 100 ng/ml. It is known that increasing the aggressiveness and metastasis of prostate cancer results in increased PSA levels [23]. Although PSA is considered to be organ-specific rather than cancer-specific, benign conditions such as prostatitis and benign prostate hyperplasia can also elevate serum PSA levels [17]. Thus, several other biomarkers have been adopted in recent years to increase the diagnostic accuracy of PSA [26]. Moreover, early detection of prostate cancer by using a baseline PSA value has been evaluated and has been shown to increase the risk of prostate cancer metastasis or mortality in male patients with a PSA >1 ng/ml at 40 years or >2 ng/ml at 60 years [14]. This emphasizes the importance of appropriately timed screening programs.

Studies have shown that the Gleason score, currently represented by the International Society of Urological Pathology (ISUP) prostate cancer grading system, correlates significantly and positively with age and PSA concentration [27]. Our study found a weak correlation between Gleason score and age and between Gleason score and PSA.

Conclusion

In conclusion, our study emphasizes the need for tailored screening programs and diagnostic strategies for prostate cancer in the Palestinian community. Despite these limitations, the findings provide valuable insights into disease patterns and highlight areas for further research. Efforts to create diagnostic and management protocols are essential for improving patient outcomes and reducing the burden of prostate cancer in the region.

Limitations of the research

Limitations of our study include the study's retrospective nature, which may introduce bias or incomplete data collection. Additionally, the single-center design of the study may limit its generalizability. The limited assessment of clinical and dietary factors is also a limitation. Furthermore, the lack of long-term follow-up data limits the assessment of treatment outcomes and disease progression.

Disclosure Statement

- **Availability of data and materials:** The data and materials utilized in this research are available upon request from the corresponding author.
- **Funding:** This research did not receive funds.
- **Author contributions:** All authors contributed equally to all study parts, including conceptualization, writing-original draft, data collection, formal analysis, investigation, methodology, writing review, and editing.
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