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The Prevalence of Benign Prostatic Hyperplasia and Prostate Cancer in Patients Referred to Shahid Beheshti Hospital in Babol (2017-2022)

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ABSTRACT

Background and Objective: Benign prostatic disease is the most prevalent prostate disorder in elderly males, giving rise to significant lower urinary tract symptoms. Furthermore, prostate cancer constitutes the second most common malignancy in men, following lung cancer, with its global incidence exhibiting an annual upward trend. Given that early detection and timely therapeutic intervention can mitigate the risk of malignant progression and reduce associated mortality, the present study was conducted to determine the prevalence of benign prostatic hyperplasia and prostate cancer in Babol, northern Iran.

Methods: In this cross-sectional study, the medical records of 573 patients who underwent either core needle biopsy or open prostate surgery at Shahid Beheshti Hospital in Babol between 2017 and 2022 were reviewed. The required data, including age, place of residence, serum PSA level, histopathological diagnosis, and Gleason grading in cases diagnosed with prostate cancer, were collected and analyzed using a standardized checklist.

Findings: The mean age of the patients was 68.64±8.72 years, and the mean PSA level was 14.44±8.59 ng/mL. Of the 573 patients, 296 underwent biopsy and 277 underwent open prostatectomy. Among the 296 biopsy patients, 247 (83.4%) were diagnosed with benign prostatic hyperplasia and 49 (16.6%) with adenocarcinoma. Among the 277 open prostatectomy patients, 241 (87.0%) had benign hyperplasia and 36 (13.0%) had adenocarcinoma. The most frequent Gleason grade group was grade 2, with 38 cases (44.7%), followed by grade 3 with 33 cases (38.8%). Grade 4 accounted for 9 cases (10.6%), grade 5 for 4 cases (4.7%), and grade 1 for 1 case (1.2%). Mean age and PSA levels were significantly higher in patients with adenocarcinoma compared to those with benign hyperplasia ($p<0.001$). No statistically significant differences were observed in mean age or PSA across different Gleason grades.

Conclusion: Our results indicated an overall prostate cancer prevalence of 15%. Additionally, a positive correlation was identified between advancing age and the increasing frequency of prostate pathologies.

Keywords: *Prostate, Adenocarcinoma, Benign Prostatic Hyperplasia, Biopsy, Open Surgery*.

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Introduction

The prostate is an endocrine gland located at the initial segment of the male urethra, which plays a role in producing seminal fluid that contributes to the maintenance and preservation of spermatozoa (1). The prostate is small during youth and gradually enlarges over time. With advancing age, the likelihood of developing prostate diseases increases (2). Benign enlargement of the prostate is known as benign prostatic hyperplasia. Prostate cancer is the second leading cause of cancer-related mortality in men, following lung cancer, and ranks among the most significant disorders that may affect the prostate (3). The prevalence of prostate cancer ranks fourth among all cancers, after breast, lung, and colorectal cancers. The five-year prevalence rate is estimated at 126.13 per 100,000 population (4).

The age-standardized incidence rate for this cancer is approximately 30.7 per 100,000 individuals, and its annual incidence is increasing in many countries (5). The prevalence of prostate cancer in Iranian men rises with age, particularly after 50 years (6). Statistically, this cancer accounts for 21% of all malignancies, making it one of the most common cancers in men. Although clinical prevalence is high, numerous cases of prostate cancer occur without ever manifesting clinically during the patient's lifetime. Prostate cancer is a disease of old age and rarely occurs before 40 years of age; its prevalence increases progressively with age, reaching its peak by the eighth decade of life. The spectrum of clinical behavior in prostate cancer reflects a broad range of therapeutic approaches. These management strategies vary from active surveillance alone to extensive surgical resection of the gland (7, 8). The American Cancer Society reported approximately 299,010 new cases of prostate cancer and approximately 35,250 deaths attributable to prostate cancer in the United States for the year 2024 (9).

The prostate-specific antigen test, which is primarily utilized for prostate cancer screening, measures the level of prostate-specific antigen (PSA) in the blood (10). PSA is a protein produced by both cancerous and non-cancerous tissue within the prostate, a small gland situated beneath the male bladder (11). PSA is predominantly found in seminal fluid, which is also produced by the prostate. Minute quantities of PSA normally circulate in the bloodstream. The PSA test can detect elevated PSA levels that may indicate the presence of prostate cancer. However, numerous other conditions, such as prostatic enlargement or inflammation, can also elevate PSA levels; therefore, the interpretation of an elevated PSA score can be complex (12). The serum PSA level alone does not definitively indicate prostate cancer. In some cases, infection or benign prostatic hyperplasia may also cause elevated serum levels. Hence, the combination of digital rectal examination with serum PSA measurement offers a more accurate diagnostic approach for prostate cancer. In subsequent stages, additional tests such as magnetic resonance imaging, ultrasonography, computed tomography, and biopsy are performed (13). The introduction of the PSA test as a screening and diagnostic modality for prostate cancer led to increased case detection in some countries; however, over time, the reservoir of undiagnosed cases in the population diminished, resulting in a subsequent decline from an initial upward trend. Conversely, in Asian and Eastern European countries, where PSA testing is less prevalent, incidence continues to exhibit an increasing trend (14). The Gleason score is a grading system developed in 1960 by the pathologist Donald Gleason (15).

The Gleason score is determined using biopsy and surgical pathology specimens. Following microscopic examination of the sample, the pathologist identifies the two areas with the highest concentration of cancerous cells and assigns a separate Gleason grade to each region, with each receiving a score between 1 and 5. Subsequently, the grade that demonstrates the greatest extent of involvement is summed with the highest observed grade, yielding a composite score commonly referred to as the Gleason score (16). Benign prostatic hyperplasia (BPH) is a highly prevalent condition in men over 50 years of age, exhibiting considerable racial and geographic variations in both incidence and mortality (17). In elderly men, BPH

presents with lower urinary tract symptoms, including urinary urgency, nocturia, frequency, dysuria, bladder emptying difficulties, and hesitancy. A global prevalence of 26.2% has been reported for BPH, with an upward trend observed over the past two decades (18).

Open prostatectomy is one of the therapeutic modalities employed to alleviate severe symptoms associated with benign prostatic hyperplasia. Since incidental adenocarcinoma is occasionally discovered in open prostatectomy specimens, this finding may substantially alter the therapeutic approach. Similarly, prostate needle biopsy, performed in cases suspected of prostate cancer, may occasionally yield only benign prostatic tissue (19). Given the rising prevalence of prostate diseases—particularly prostate cancer—and the absence of comparable studies in the northern region of the country examining the frequency of histopathological findings in biopsy or open prostatectomy specimens, and recognizing that early diagnosis and timely intervention can reduce mortality, the present study was undertaken to determine the prevalence of benign prostatic hyperplasia and prostate cancer in Babol.

Methods

Following approval by the Ethics Committee of Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1402.311), this cross-sectional study was performed using a census approach on all patients referred to Shahid Beheshti Hospital who underwent prostate biopsy or open surgery between 2017 and 2022. Patients with complete medical records who had undergone either needle biopsy or open prostatectomy during the study period were included. Those with incomplete records, surgeries for non-prostate/non-BPH indications, or procedures outside the defined timeframe were excluded. Using the prostate disease prevalence from Onwuasoanya et al. (20) (P=0.26) and a relative error of 0.05, the target sample size was determined to be 296 patients.

The medical records of eligible patients who had undergone either biopsy or open prostatectomy were retrieved from the relevant archives of the Pathology Department at Shahid Beheshti Hospital. The required data, including age, pre-biopsy or pre-surgical serum PSA levels, histopathological diagnosis, and Gleason grading (both quantitatively and qualitatively) in cases diagnosed with prostate cancer, were recorded using a pre-designed checklist. The indications for prostate biopsy included a positive digital rectal examination, a PSA level greater than 4 ng/mL irrespective of age, a PSA level between 2.5 and 3 ng/mL in patients under 60 years of age, a PSA velocity exceeding 0.75 ng/mL/year, or metastatic adenocarcinoma with an unknown primary origin. Open prostatectomy was performed for benign prostatic enlargement. In cases where prostate cancer was confirmed, the Gleason score was assessed, with a minimum score of 6 indicating low-grade cancer, a score of 7 indicating intermediate-grade cancer, and scores of 8, 9, or 10 indicating high-grade cancer. Grading was further categorized as follows: Grade 1: Gleason score $\leq$6; Grade 2: Gleason score 7 with a primary grade of 3 and secondary grade of 4; Grade 3: Gleason score 7 with a primary grade of 4 and secondary grade of 3; Grade 4: Gleason score 8; and Grade 5: Gleason score 9 or 10 (16). Data were analyzed using SPSS version 25. After assessing normality, Fisher's exact test, chi-square test, and non-parametric tests (Mann-Whitney) were employed, with a p-value of less than 0.05 considered statistically significant.

Results

In this study, of the 591 men referred to Shahid Beheshti Hospital in Babol between 2017 and 2022 who underwent either core needle biopsy or open prostate surgery, 10 were excluded due to incomplete medical records and 8 met the exclusion criteria, leaving a final cohort of 573 patients. The mean age of the patients

was 68.64±8.72 years, and the mean PSA level was 14.44±8.59 ng/mL. Based on histopathological findings, 488 cases (85.2%) were diagnosed with benign prostatic hyperplasia, and 85 cases (14.8%) were diagnosed with adenocarcinoma. Of the total, 296 patients (51.7%) underwent biopsy for diagnostic evaluation of prostate diseases, while 277 patients (48.3%) underwent open prostatectomy. Among the 85 specimens with a diagnosis of adenocarcinoma, 26 cases (30.6%) were localized to the left lobe, 25 cases (29.4%) to the right lobe, and 34 cases (40.0%) were bilateral.

The mean Gleason score among the 85 patients with confirmed adenocarcinoma was 7.19±0.52, with a median of 7, and scores ranging from a minimum of 6 to a maximum of 9. The most frequent Gleason grade group was grade 2, observed in 38 cases (44.7%), followed by grade 3 in 33 cases (38.8%). Gleason grade 2 was reported with equal frequency in both left-sided and right-sided tumors. However, in bilateral specimens, grade 3 was the most prevalent, accounting for 21 cases (61.8%) (Table 1).

Based on Gleason score stratification in the 85 adenocarcinoma patients, 1 case (1.2%) was classified as low-grade, 38 cases (44.7%) as intermediate-grade, and 46 cases (54.1%) as high-grade. Normality testing indicated that the baseline variables did not follow a normal distribution; therefore, the non-parametric Mann-Whitney U test was employed. Comparative analysis of mean age and PSA levels between patients with BPH and those with adenocarcinoma revealed that both mean age and PSA were significantly higher in the adenocarcinoma group compared to the BPH group ($p<0.001$) (Table 2).

Among the 296 patients who underwent biopsy, 247 (83.4%) were diagnosed with benign prostatic hyperplasia and 49 (16.6%) with adenocarcinoma. Among the 277 patients who underwent open prostatectomy, 241 (87.0%) were diagnosed with BPH and 36 (13.0%) with adenocarcinoma. Comparative analysis of mean age and PSA levels across different Gleason grades in patients with adenocarcinoma revealed no statistically significant differences (Table 3). The age group of 71-80 years accounted for the highest proportion of high-grade malignancies at 48.2%. Furthermore, 50% of all high-grade Gleason score cases were observed within this age group (Figure 1).

Table 1. Frequency distribution of Gleason score according to the affected side in 85 patients diagnosed with adenocarcinoma

Group / Gleason Grade	Total (n=85) n(%)	Left side (n=26) n(%)	Right side (n=25) n(%)	Bilateral (n=34) n(%)
Grade 1	1(1.2)	1(3.8)	-	-
Grade 2	38(44.7)	19(73.1)	19(76.0)	-
Grade 3	33(38.8)	6(23.1)	6(24.0)	21(61.8)
Grade 4	9(10.6)	-	-	9(26.5)
Grade 5	4(4.7)	-	-	4(11.8)

Table 2. Comparison of age and PSA levels between patients diagnosed with hyperplasia and those with adenocarcinoma

Diagnosis / Variable	Benign Prostatic Hyperplasia (Mean±SD)	Adenocarcinoma (Mean±SD)	p-value*
Age (years)	66.88±7.89	78.74±5.98	<0.001
PSA (ng/mL)	11.67±4.51	30.31±9.24	<0.001

*Using the Mann-Whitney U test

Table 3. Comparison of age and PSA levels in patients diagnosed with adenocarcinoma according to Gleason grade

Gleason Grade Variables	Low Grade Mean±SD	Intermediate Grade Mean±SD	High Grade Mean±SD	p-value*
Age (years)	86.00±0.00	78.08±6.58	79.13±5.43	0.296
PSA (ng/mL)	13.10±0.00	30.57±8.89	30.47±9.37	0.279

*Using the Kruskal-Wallis test

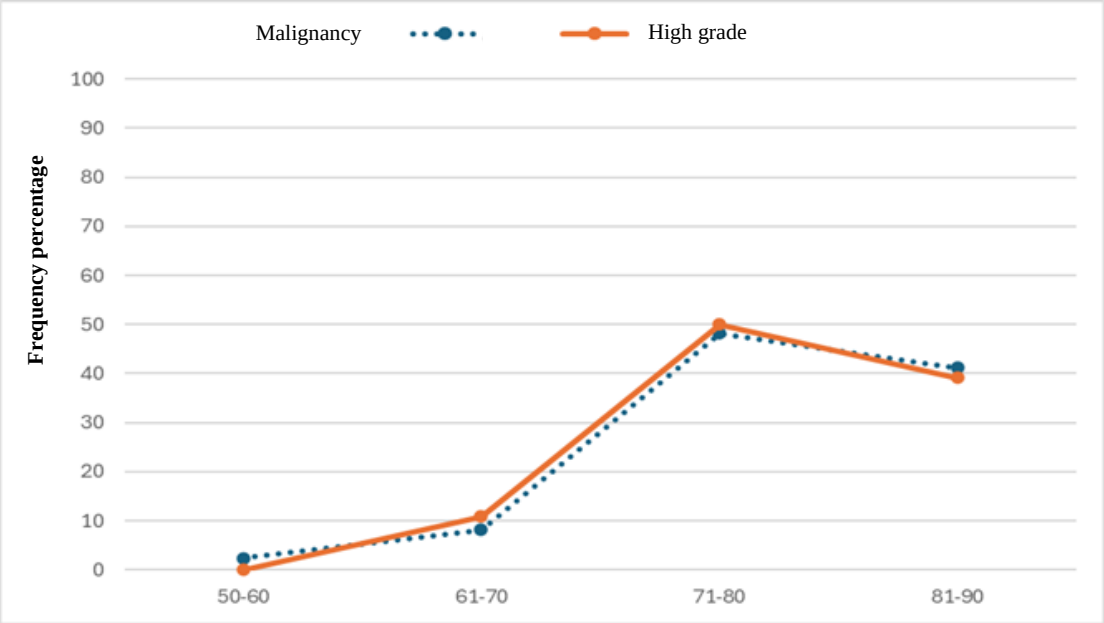


Figure 1. Age distribution pattern of patients according to malignancy diagnosis and high-grade Gleason score

Discussion

In this study, the results indicated a prevalence of 85.2% for benign prostatic hyperplasia and 14.8% for adenocarcinoma over a 5-year period in Babol. Given that prostate needle biopsy is performed in cases with suspected malignancy, whereas open prostatectomy is conducted for benign prostatic enlargement, the relatively close rates of adenocarcinoma detection—16.6% in needle biopsy versus 13.0% in open prostatectomy—are noteworthy. In the study by Farahmand et al. (21), the age-standardized incidence rate of prostate cancer in 2008 was reported as 16.02%, and in the study by Barati et al. in 2015, it was 15.3% (22), which are considerably lower than rates reported in other regions of the world, particularly in developed countries. This disparity may potentially be attributed to a lack of screening programs or deficiencies in case registration. Askari et al., in their study, reported a prostate cancer incidence of 1.5 per 100,000 population per year across five Iranian provinces between 1995 and 1999 (23); however, the cancer registry system did not capture all cases, suggesting that the reported figures are likely underestimates of the true incidence. Malekzadeh et al. noted that prostate cancer in Iran, similar to other developing countries, is on the rise (24).

Studies by Hsing et al. and Mallick et al. concluded that the incidence of prostate cancer varies considerably across countries and among populations of different ethnicities, ranging from 4-7 cases per 100,000 population in Asian countries to 70-100 cases per 100,000 population in European and North American countries. Some studies have reported differences of up to 90-fold between different geographic regions (25, 26).

The observed heterogeneity in prostate cancer prevalence across a single county may be attributed to a multifactorial interplay of variables, including differences in lifestyle practices, local environmental conditions, proximity to industrial or agricultural zones, dietary patterns, genetic susceptibility, and disparities in healthcare access, diagnostic accuracy, and treatment availability. One of the notable findings of the present study was the markedly elevated serum PSA level observed in patients with prostatic adenocarcinoma relative to those with benign hyperplastic disease, underscoring the utility of this biomarker in distinguishing malignant from benign pathology. The widespread adoption of PSA testing has significantly improved the early detection of prostate cancer, particularly in asymptomatic men who might otherwise remain undiagnosed until advanced stages (27). Moreover, the work of Grubb et al. (28) provided compelling evidence that combined screening employing both PSA measurement and digital rectal examination not only increases the detection of incident cases but also contributes to a measurable reduction in prostate cancer–specific mortality. In line with this, our data revealed that the mean age of patients with adenocarcinoma was substantially higher than that of patients with BPH, reinforcing the well-established epidemiological principle that prostate cancer risk escalates with chronological age. The highest concentration of both disease prevalence and high-grade Gleason scores was observed within the 71-80-year age group. This age-dependent pattern is consistent with the findings of Tan et al. (29), who reported a similar progressive increase in prostate cancer incidence with age, and is further corroborated by Barati et al. (22), who documented a statistically significant rise in registered prostate cancer cases corresponding to increasing age in the Iranian population.

The findings of the study by Mazloumi et al. demonstrated that advancing age is associated with higher Gleason scores (30). Shafi et al. also reported that men in the 60–80–year age group have a greater likelihood of developing prostate cancer compared to other age groups (31). Examination of age-standardized incidence rates indicates that prostate cancer is predominantly a disease of elderly and older men, with the majority of cases occurring after the age of 50 and peaking in the 70–80–year age group. Notably, over 99% of age-standardized incidence occurs in men over 50 years of age, with more than 82% of cases attributable to those aged 70 years and older (9).

The results of the study by Vahednasiri demonstrated a significant association between the number of prostatic neoplasms and age groups (32). Therefore, greater attention should be directed toward other laboratory tests, radiological imaging, and ultrasonographic evaluations. In addition to clinical examination, screening programs—particularly for individuals aged 50 years and older—should be implemented using prostate-specific antigen testing for early detection of this malignancy.

Given that the country's demographic composition is shifting toward an aging population, primary prevention, diagnostic testing, and awareness among men who are within the age range for prostate cancer development are essential for facilitating appropriate diagnostic evaluations. However, a declining trend in prostate cancer prevalence was observed in the 81–90–year age group, which may reflect changes in clinical practice regarding screening for elderly men with suspected prostate cancer. The results of this study indicate an increasing trend in prostate cancer incidence in the country. This rise may be attributed to improvements in the cancer registration system in Iran, the emergence of new and accurate diagnostic and screening modalities, increased public awareness, greater patient referral and follow-up, increased life expectancy and aging of the male population, and overall enhancement of the healthcare system in detecting

suspected cases. A limitation of this study was the lack of evaluation of digital rectal examination (DRE) findings. It is recommended that future studies investigate the prevalence of positive DRE and urological symptoms in patients with prostate cancer. Greater efforts should be directed toward early detection of prostatic adenocarcinoma to reduce morbidity and mortality associated with this disease.

The findings derived from this investigation reveal a prostate cancer prevalence of 15%, a figure that aligns closely with previously reported rates from various other regions within Iran, thereby reinforcing the consistency of the disease burden across the country. Importantly, the data clearly demonstrate a progressive increase in disease incidence with advancing age, underscoring the critical role of age as a primary risk factor. In light of the ongoing demographic aging of the Iranian population, coupled with rapid and profound changes in lifestyle patterns that may further modulate cancer risk, it becomes increasingly urgent to implement well-structured and evidence-based planning for the delivery of thorough and timely clinical evaluations. Such strategic efforts are indispensable for achieving early detection, enabling prompt and appropriate therapeutic intervention, and ultimately reducing the morbidity and mortality associated with this increasingly prevalent malignancy.

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