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Artikel Penelitian

KARAKTERISTIK KLINIKOHISTOPATOLOGI LESI PROSTAT DI RUMAH SAKIT PENDIDIKAN PROF. DR. CHAIRUDDIN PANUSUNAN LUBIS MEDAN, 2023–2024

CLINICOHISTOPATHOLOGICAL CHARACTERISTICS OF PROSTATE LESIONS AT RUMAH SAKIT PENDIDIKAN PROF. DR. CHAIRUDDIN PANUSUNAN LUBIS MEDAN, 2023-2024

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A B S T R A K

Pembesaran prostat merupakan masalah kesehatan global pada pria lanjut usia akibat lesi non-neoplastik maupun neoplastik, paling sering bermanifestasi sebagai *lower urinary tract symptoms*. *Benign Prostatic Hyperplasia* (BPH) adalah etiologi non-neoplastik tersering, sedangkan *Acinar Prostatic Carcinoma* (APC) adalah lesi neoplastik ganas tersering; *High-Grade Prostatic Intraepithelial Neoplasia* (HGPIN) sebagai lesi prekursor serta *Atypical Small Acinar Proliferation* (ASAP) sebagai proliferasi asinar atipikal mencurigakan menjadi *critical differential diagnoses* serta *pitfall* yang berimplikasi terhadap tatalaksana dan prognosis. Penelitian ini merupakan studi *retrospective cross-sectional* dengan metode *total sampling* untuk mengidentifikasi karakteristik klinikohistopatologi lesi prostat pada pasien yang menjalani *core needle biopsy prostate* dan/atau *transurethral resection of the prostate* di Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis Medan, periode Januari 2023–Juni 2024. Evaluasi histopatologi dilakukan dengan pewarnaan *Hematoxylin and Eosin*. Sebanyak 43 spesimen dianalisis secara deskriptif; terdiri dari 33 kasus (76,74%) *BPH* dan 10 kasus (23,26%) *APC*; *ASAP* dan *HGPIN* tidak dijumpai. Kelompok usia tersering pada lesi prostat jinak maupun ganas adalah 60–69 tahun, sedangkan usia termuda 50–59 tahun. Kesesuaian antara *ultrasonography* dengan diagnosis histopatologi ditemukan pada 83,33% kasus *BPH* dan 66,67% kasus *APC*. Spesimen *BPH* menunjukkan *dominant glandular architecture* berupa *papillary infolding* dan *cystic atrophy*; *intraluminal secretion* berupa *corpora amylacea*; serta *squamous metaplasia* sebagai gambaran khusus. Spesimen *APC* menunjukkan *dominant glandular architecture* berupa *tufting*, *cribriform*, *micropapillary*; *intraluminal secretion* berupa *blue mucin* dan *crystalloid*; serta morfologi *signet-ring cell* sebagai gambaran khusus. Lesi jinak dicirikan dengan *papillary infolding*, *cystic atrophy*; *corpora amylacea*, sedangkan lesi ganas dicirikan dengan *tufting*, *cribriform*, *micropapillary*; *blue mucin* dan *crystalloid*.

A B S T R A C T

Prostatic enlargement is a global health problem among older men, caused by non-neoplastic or neoplastic lesions and commonly presenting as lower urinary tract symptoms. Benign Prostatic Hyperplasia (BPH) is the leading non-neoplastic etiology, whereas Acinar Prostatic Carcinoma (APC) is the most common malignant neoplasm. High-Grade Prostatic Intraepithelial Neoplasia (HGPIN), a precursor lesion, and Atypical Small Acinar Proliferation (ASAP), a suspicious atypical acinar proliferation, are critical differential diagnoses and pitfalls influencing management and prognosis. Using total sampling, this retrospective cross-sectional study characterized clinicohistopathological features of prostatic lesions in patients undergoing prostate core needle biopsy and/or transurethral resection of the prostate at Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis Medan, from January 2023 to June 2024. Histopathological evaluation used hematoxylin and eosin staining. Forty-three specimens were analyzed descriptively: 33 (76.74%) were BPH and 10 (23.26%) were APC; neither ASAP nor HGPIN was identified. Benign and malignant lesions occurred most frequently among patients aged 60–69 years; the youngest were aged 50–59 years. Ultrasonographic diagnoses agreed with histopathology in 83.33% of BPH cases and 66.67% of APC cases. BPH specimens predominantly showed papillary infolding and cystic atrophy, corpora amylacea as the principal intraluminal secretion, and squamous metaplasia as a distinctive finding. APC specimens predominantly showed tufting, cribriform, and micropapillary architectures; blue mucin and crystalloids as intraluminal secretions; and signet-ring cell morphology as a distinctive finding. Benign lesions showed papillary infolding and cystic atrophy, with intraluminal corpora amylacea. Malignant lesions showed tufting, cribriform and micropapillary patterns, with intraluminal blue mucin and crystalloids.

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INTRODUCTION

Prostate enlargement is a global health problem among aging men and commonly presents as lower urinary tract symptoms (LUTS). This clinical presentation is not specific to a single lesion: it may arise from non-neoplastic benign prostatic hyperplasia (BPH), precursor lesions such as high-grade prostatic intraepithelial neoplasia (HGPIN), a suspicious atypical small acinar proliferation (ASAP), or malignant acinar prostatic carcinoma (APC).[1] The resulting burden is therefore not limited to urinary symptoms, but also includes the diagnostic assessment, repeat investigations, and management decisions needed to distinguish benign, premalignant, and malignant processes. This spectrum is particularly important in specimens obtained through prostate biopsy or transurethral resection of the prostate (TUR-P).

BPH is the most frequent non-neoplastic cause of prostate enlargement. Globally, BPH prevalence increases with age; epidemiological syntheses indicate that approximately 50–60% of men in their sixth decade are affected based on histological or clinical evidence, rising to around ≥80% among men aged ≥70 years.[2,3] In Asia, a similar age-related trend has been reported, with global burden of disease analyses identifying BPH as a major health issue in aging male populations; a meta-analysis from China reported a pooled BPH prevalence of approximately 36.6% among men aged ≥40 years, with a clear increase with advancing age.[3,4] In Indonesia, fully representative population-based data remain limited; however, national reports and clinical consensus consistently identify BPH as the principal cause of prostate enlargement in men aged ≥50 years, with prevalence estimates commonly cited at approximately 30–40% and increasing in older age groups.[5,6] In patients with severe BPH symptoms, TUR-P remains a common procedure to relieve obstruction and improve quality of life.[7]

The same symptoms and radiological impression of prostate enlargement may also occur in patients with APC or in lesions requiring careful distinction from carcinoma. Incidental prostate carcinoma in TUR-P specimens is still reported in patients undergoing surgery for presumed BPH, reflecting clinical overlap between BPH and previously undetected carcinoma.[7,8] Histopathology remains the definitive diagnostic standard for APC, based on integrated assessment of infiltrative growth, nuclear atypia with prominent nucleoli, and absence of basal cells, which may be confirmed immunohistochemically. However, adenocarcinoma diagnosis—especially in minimal or fragmented specimens—may be confounded by pseudoneoplastic mimickers such as prostatic atrophy and basal cell hyperplasia, increasing the risk of overdiagnosis or interpretative bias.[9] The term ASAP applies to small acinar foci with suspicious atypia that do not meet criteria for definitive carcinoma and is clinically relevant because it is associated with a higher likelihood of prostate cancer detection on subsequent evaluation or repeat biopsy.[10,11] Current uropathology consensus no longer recommends reporting low-grade prostatic intraepithelial neoplasia because of its limited clinical significance, whereas HGPIN—particularly when multifocal or isolated—

remains clinically relevant as a precursor that may predict subsequent carcinoma detection.[12,13]

Prostate cancer, most commonly APC, is among the most common malignancies in men and remains a major cause of cancer-related mortality worldwide. GLOBOCAN analyses indicate that in 2020 it was the second most frequently diagnosed cancer and the fifth leading cause of cancer-related death among men worldwide.[14,15] In regions with a high Human Development Index, the mortality burden remains substantial; GLOBOCAN 2022 reported 33,746 prostate cancer-related deaths in the United States, while in Europe, prostate cancer ranks among the three most commonly diagnosed malignancies and leading causes of cancer-related death in men.[16,17] In Asia, prostate cancer incidence is generally lower but heterogeneous and increasing; GLOBOCAN 2022 analyses across ASEAN countries demonstrate wide variation in age-standardized incidence rates, with higher rates in Singapore and the Philippines and lower rates in several Indochinese countries, reflecting differences in screening practices, healthcare access, and population-specific biological factors.[18] In Indonesia, the disease burden is also considerable, with GLOBOCAN data identifying prostate cancer as a significant contributor to male cancer incidence and mortality, supported by reports from tertiary teaching hospitals in Jakarta, Surabaya, and Bandung showing substantial case accumulation and a mean patient age in the seventh decade.[17,19]

Given the global and regional burden and the overlapping clinical and morphologic spectrum of prostate lesions, this study aimed to examine the clinicohistopathological characteristics of prostate lesions at the Unit of Anatomical Pathology, Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis Medan. To date, no similar study has been conducted at this institution. The findings are expected to provide valuable insights for clinicians and pathologists in recognizing the morphologic basis for separating benign, premalignant, and malignant lesions, while also contributing institutional epidemiological data on prostate enlargement.

METHODS

This study was descriptive research with a cross-sectional design. The study was conducted retrospectively by reviewing secondary data from medical records and histopathological slides. The research was carried out at the Unit of Anatomical Pathology, Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis Medan. The study period covered specimens collected from January 2023 to June 2024. This study design was selected to describe the clinicopathological and histomorphological characteristics of prostate lesions without intervention or follow-up.

The study population consisted of all patients with prostate lesions who underwent histopathological examination at the Unit of Anatomical Pathology, Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis Medan, during the study period. The study sample included all histopathological specimens obtained from patients who underwent core needle biopsy of the prostate and/or TUR-P. A total sampling technique was applied, whereby

all cases that met the inclusion criteria were included in the study. The inclusion criteria comprised cases with available secondary medical record data, including age, clinical diagnosis, histopathological diagnosis, prostate-specific antigen (PSA) levels (if available), ultrasound radiological diagnosis (if available), and adequate histopathological slides. The exclusion criteria were loss or damage of histopathological slides and cases in which paraffin blocks were exhausted during re-cutting for slide preparation, rendering histopathological evaluation impossible. No sample size calculation formula was applied because all eligible cases during the study period were included.

Data were collected retrospectively from medical records and histopathology archives. All slides were reviewed using Hematoxylin and Eosin (H&E) staining. Histopathological evaluation was performed independently by two anatomical pathologists and one senior anatomical pathology resident. The assessed clinicohistopathological variables included dominant glandular architecture, nuclear characteristics, chromatin pattern, nucleoli, mitotic activity, cytoplasmic features, dominant intraluminal secretion, inflammatory cells, lesion with special features, age, PSA level, clinical diagnosis, concordance between ultrasound and histopathological diagnosis, and lesion behaviour. All measurements and laboratory values were recorded using standard clinical units as documented in the medical records.

Data were processed and analyzed using descriptive statistical methods. Statistical analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) software, version 26.0 (Build 1.0.0.1207). The results were presented as frequencies and percentages. No inferential statistical testing or confidence interval estimation was performed, as the study was purely descriptive in nature.

This study was conducted after obtaining ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara, and Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis Medan. The ethical approval number was 1112/KEPK/USU/2024. As this study used retrospective secondary data from medical records and archived histopathological slides, informed consent from individual patients was waived by the ethics committee.

RESULTS

This study was descriptive and reported all *a priori* prespecified clinicohistopathological variables as frequency distributions, thereby providing a comprehensive overview of the clinical and histomorphological characteristics of the study sample. A total of 43 specimens were analyzed, comprising 33 cases (76.74%) of BPH and 10 cases (23.26%) of APC; no cases of ASAP or HGPIN were identified. (Table 1) provides an integrated presentation of all sample characteristics according to histopathological diagnosis, including the clinical variables of age, PSA level, clinical diagnosis, ultrasonographic diagnosis, and its concordance with histopathological diagnosis. Histopathological variables included dominant glandular architecture, nuclear features, chromatin,

nucleoli, mitotic activity, cytoplasm, dominant intraluminal secretion, inflammatory cells, special lesion features, and lesion biological behavior. (Table 2) presents the distribution of PSA levels, dominant glandular architecture, and dominant intraluminal secretion across age groups, whereas (Table 3) presents the distribution of dominant glandular architecture and dominant intraluminal secretion according to lesion biological behavior. Representative microscopic images are presented with their respective figure legends.

Table 1. Characteristics of the study sample.

Variable	Histopathological Diagnosis			
	BPH	ASAP	HGPIN	APC
	n=33 (76.74%)	n=0 (0%)	n=0 (0%)	n=10 (23.26%)
Age				
40 – 49 years old	0 (0%)	0 (0%)	0 (0%)	0 (0%)
50 – 59 years old	5 (11.63%)	0 (0%)	0 (0%)	1 (2.33%)
60 – 69 years old	16 (37.20%)	0 (0%)	0 (0%)	7 (16.28%)
70 – 79 years old	10 (23.26%)	0 (0%)	0 (0%)	2 (4.65%)
≥80 years old	2 (4.65%)	0 (0%)	0 (0%)	0 (0%)
PSA Levels				
≤4,0 ng/ml	3 (6.98%)	0 (0%)	0 (0%)	0 (0%)
4,1-10 ng/ml	2 (4.65%)	0 (0%)	0 (0%)	0 (0%)
>10 ng/ml	2 (4.65%)	0 (0%)	0 (0%)	3 (6.98%)
PSA examination not available	26 (60.46%)	0 (0%)	0 (0%)	7 (16.28%)
Clinical Diagnosis				
Prostate enlargement suggestive BPH	25 (58.14%)	0 (0%)	0 (0%)	3 (6.98%)
Prostate enlargement suggestive prostatic carcinoma	8 (18.60%)	0 (0%)	0 (0%)	7 (16.28%)
Ultrasonography Data Availability and Concordance with Histopathological Diagnosis				
Available ultrasonography data – concordant with histopathological diagnosis	15 (34.88%)	0 (0%)	0 (0%)	2 (4.65%)
Available ultrasonography data – discordant with histopathological diagnosis	3 (6.98%)	0 (0%)	0 (0%)	1 (2.33%)
Ultrasonography data not available	15 (34.88%)	0 (0%)	0 (0%)	7 (16.28%)
Behaviour of The Lesion				
Benign	33 (76.74%)	0 (0%)	0 (0%)	0 (0%)
Premalignant	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Malignant	0 (0%)	0 (0%)	0 (0%)	10 (23.26%)
Dominant Glandular Architecture				
Papillary infolding	16 (37.21%)	0 (0%)	0 (0%)	0 (0%)
Tufting	0 (0%)	0 (0%)	0 (0%)	5 (11.63%)
Micropapillary	0 (0%)	0 (0%)	0 (0%)	1 (2.33%)
Flat	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cribriform	0 (0%)	0 (0%)	0 (0%)	4 (9.30%)
Cystic atrophy	17 (39.53%)	0 (0%)	0 (0%)	0 (0%)
Nuclei				
Normonuclei	33 (76.74%)	0 (0%)	0 (0%)	0 (0%)
Macronuclei	0 (0%)	0 (0%)	0 (0%)	10 (23.26%)
Chromatin				
Normochromatic	33 (76.74%)	0 (0%)	0 (0%)	0 (0%)
Vesicular	0 (0%)	0 (0%)	0 (0%)	4 (9.30%)
Hyperchromatic	0 (0%)	0 (0%)	0 (0%)	6 (13.96%)
Nucleoli				
Normonucleoli	33 (76.74%)	0 (0%)	0 (0%)	2 (4.65%)
Macronucleoli	0 (0%)	0 (0%)	0 (0%)	8 (18.61%)

Variable	Histopathological Diagnosis			
	BPH	ASAP	HGPIN	APC
	n=33 (76.74%)	n=0 (0%)	n=0 (0%)	n=10 (23.26%)
Mitosis				
None	33 (76.74%)	0 (0%)	0 (0%)	10 (23.26%)
Present	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cytoplasm				
Eosinophilic	33 (76.74%)	0 (0%)	0 (0%)	10 (23.26%)
Amphophilic	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dominant Intraluminal Secretion				
None	3 (6.97%)	0 (0%)	0 (0%)	2 (4.65%)
Corpora amylacea	23 (53.49%)	0 (0%)	0 (0%)	2 (4.65%)
Blue mucin	0 (0%)	0 (0%)	0 (0%)	1 (2.33%)
Pink amorphous	7 (16.28%)	0 (0%)	0 (0%)	3 (6.98%)
Crystalloid	0 (0%)	0 (0%)	0 (0%)	2 (4.65%)
Inflammatory Cells				
None	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Present	33 (76.74%)	0 (0%)	0 (0%)	10 (23.26%)
Lesion with Special Features				
None	5 (11.63%)	0 (0%)	0 (0%)	9 (20.93%)
BPH with non-specific chronic inflammatory process	22 (51.16%)	0 (0%)	0 (0%)	0 (0%)
BPH with cystitis / polypoid cystitis	2 (4.65%)	0 (0%)	0 (0%)	0 (0%)
BPH with focus of squamous metaplasia	3 (6.97%)	0 (0%)	0 (0%)	0 (0%)
BPH with focus of urothelial carcinoma	1 (2.33%)	0 (0%)	0 (0%)	0 (0%)
APC with focal signet-ring cell feature	0 (0%)	0 (0%)	0 (0%)	1 (2.33%)

Table 2. Clinicohistopathological characteristics based on age variables with PSA levels, dominant glandular architecture and dominant intraluminal secretion.

Variable	Age				
	40 – 49 years old	50 – 59 years old	60 – 69 years old	70 – 79 years old	≥ 80 years old
	n=0 (0%)	n=6 (13.95%)	n=23 (53.49%)	n=12 (27.91%)	n=2 (4.65%)
PSA Levels					
≤4,0 ng/ml	0 (0%)	1 (2.33%)	1 (2.33%)	0 (0%)	1 (2.33%)
4,1-10 ng/ml	0 (0%)	1 (2.33%)	0 (0%)	1 (2.33%)	0 (0%)
>10 ng/ml	0 (0%)	1 (2.33%)	2 (4.66%)	1 (2.33%)	1 (2.33%)
PSA examination data not available	0 (0%)	3 (6.96%)	20 (46.50%)	10 (23.25%)	0 (0%)
Dominant Glandular Architecture					
Papillary infolding	0 (0%)	3 (6.96%)	8 (18.62%)	5 (11.63%)	0 (0%)
Tufting	0 (0%)	1 (2.33%)	3 (6.96%)	1 (2.33%)	0 (0%)
Micropapillary	0 (0%)	0 (0%)	1 (2.33%)	0 (0%)	0 (0%)
Flat	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cribriform	0 (0%)	0 (0%)	3 (6.96%)	1 (2.33%)	0 (0%)
Cystic atrophy	0 (0%)	2 (4.66%)	8 (18.62%)	5 (11.63%)	2 (4.66%)
Dominant Intraluminal Secretion					
None	0 (0%)	2 (4.66%)	2 (4.66%)	1 (2.33%)	0 (0%)
Corpora amylacea	0 (0%)	3 (6.96%)	11 (25.58%)	10 (23.25%)	1 (2.33%)
Blue mucin	0 (0%)	0 (0%)	1 (2.33%)	0 (0%)	0 (0%)
Pink amorphous	0 (0%)	1 (2.33%)	7 (16.26%)	1 (2.33%)	1 (2.33%)
Crystalloid	0 (0%)	0 (0%)	2 (4.66%)	0 (0%)	0 (0%)

Table 3. Clinicohistopathological characteristics based on the behaviour of the lesion variable with dominant glandular architecture and dominant intraluminal secretion.

Variable	Behaviour of The Lesion		
	Benign	Premalignant	Malignant
	n=33 (76.74%)	n=0 (0%)	n=10 (23.26%)
Dominant Glandular Architecture			
Papillary infolding	16 (37.21%)	0 (0%)	0 (0%)
Tufting	0 (0%)	0 (0%)	5 (11.63%)
Micropapillary	0 (0%)	0 (0%)	1 (2.33%)
Flat	0 (0%)	0 (0%)	0 (0%)
Cribriform	0 (0%)	0 (0%)	4 (9.30%)
Cystic atrophy	17 (39.53%)	0 (0%)	0 (0%)
Dominant Intraluminal Secretion			
None	3 (6.98%)	0 (0%)	2 (4.65%)
Corpora amylacea	23 (53.48%)	0 (0%)	2 (4.65%)
Blue mucin	0 (0%)	0 (0%)	1 (2.33%)
Pink amorphous	7 (16.28%)	0 (0%)	3 (6.98%)
Crystalloid	0 (0%)	0 (0%)	2 (4.65%)

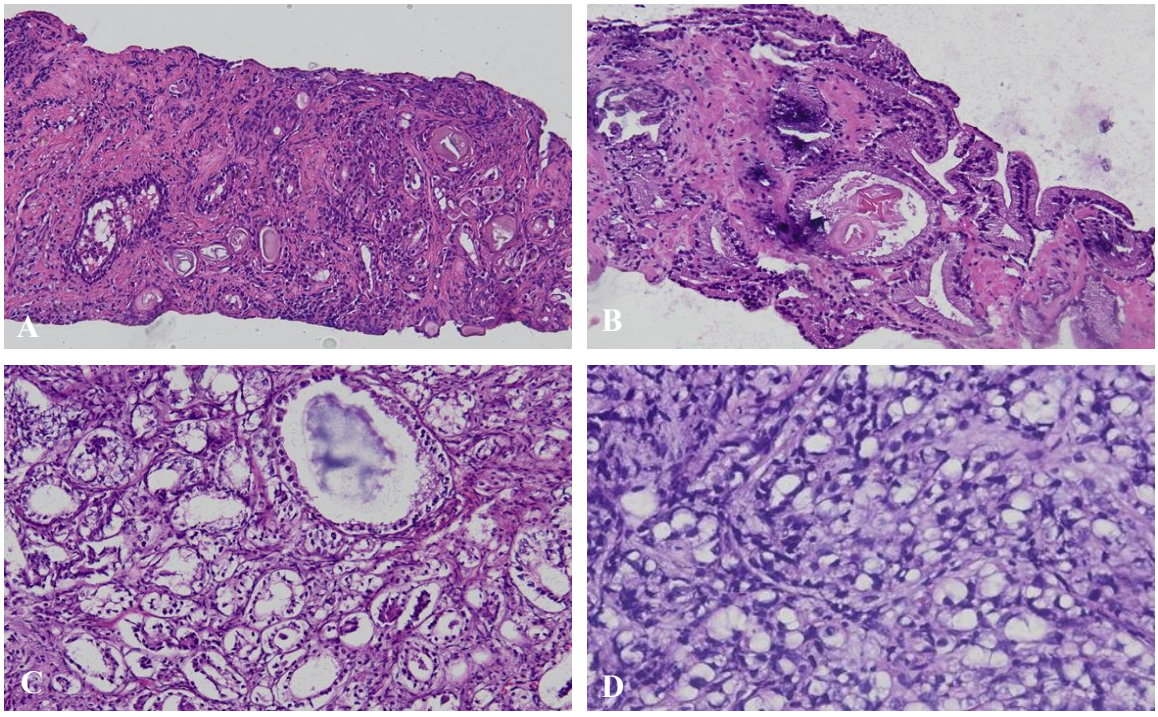

Figure 1. Acinar Prostatic Carcinoma. **A.** The lumen contains pink amorphous secretion, some with corpora amylacea (200×, H&E). **B.** The lumen contains crystalloid and pink amorphous secretion (200×, H&E). **C.** The lumen contains a mass of blue mucin secretion (200×, H&E). **D.** Acinar prostatic carcinoma with focal signet-ring cell feature (400×, H&E).

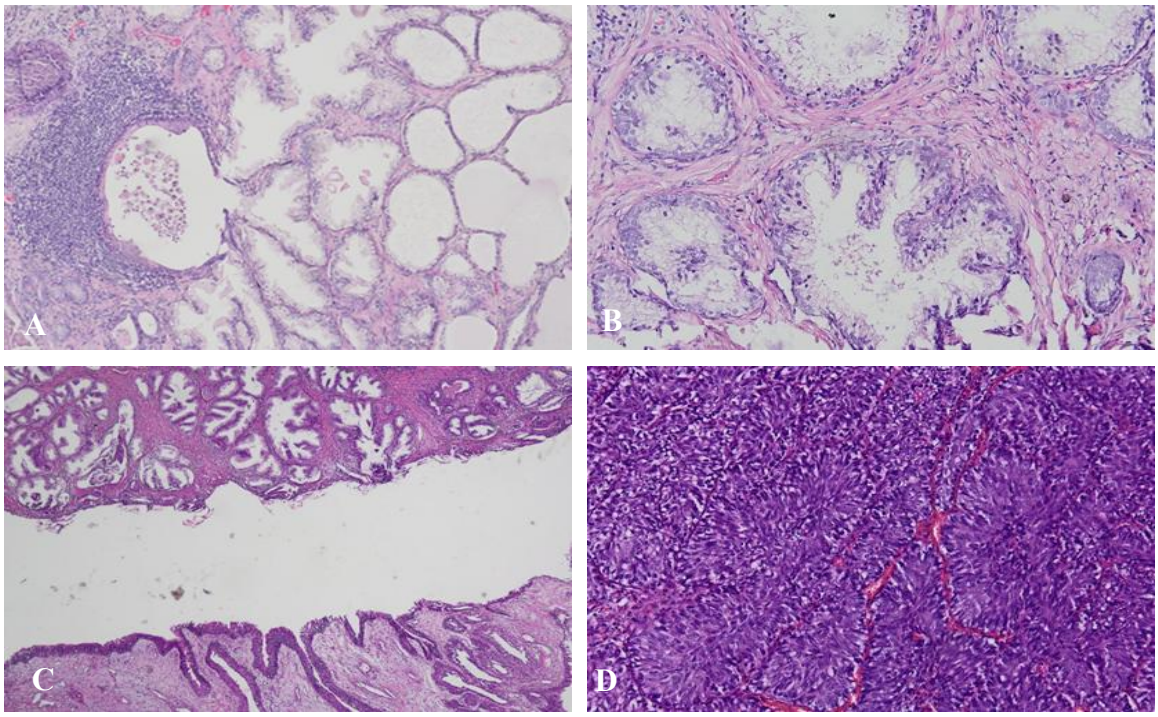

Figure 2. A. BPH with chronic non-specific inflammatory process (100×, H&E). **B.** BPH with squamous metaplasia (200×, H&E). **C.** BPH with polypoid cystitis (100×, H&E). **D.** BPH with focus of urothelial carcinoma, a solid tumor mass consisting of proliferating malignant urothelial cells (200×, H&E).

DISCUSSION

Anatomically, TUR-P primarily samples periurethral tissue and the transition zone, the principal site of nodular hyperplasia in BPH that may cause obstruction; therefore, BPH is more commonly encountered in TUR-P specimens.[2,9] ASAP is a diagnostic term for small acinar foci that are suspicious but do not yet meet the morphologic criteria for APC, whereas HGPIN is a precursor lesion that is generally focal and more often associated with the peripheral zone.[10–13] Because of its focal nature and peripheral-zone predilection, HGPIN may not always be sampled and may be identified only incidentally in series of prostate core needle biopsy and TUR-P specimens.[12,13] In this study, the histopathological diagnoses were BPH in 33 of 43 specimens (76.74%) and APC in 10 specimens (23.26%), whereas ASAP and HGPIN were not identified. The predominance of BPH is consistent with the characteristics of lesions that develop in the transition zone and cause obstruction. The identification of APC in 10 specimens indicates that prostatic enlargement is not always caused by a benign lesion; therefore, histopathological examination is necessary to distinguish benign lesions from malignancy. The absence of ASAP indicates that, after histomorphological evaluation including glandular architecture, luminal-cell morphology, and the presence of the basal-cell layer, no foci suspicious for APC were identified. Overall, all lesions in this study could be definitively classified as BPH or APC.

These findings reinforce the well-established age-dependent increase in BPH.

Population-based data indicate that more than 50% of men aged ≥60 years exhibit benign prostatic enlargement, which aligns with the predominance of the 60–69-year group observed in the present study.[20] The prevalence is known to rise further in subsequent decades, reaching approximately ≥70% among men aged ≥70 years, reflecting the strong biological association between prostatic stromal–epithelial hyperplasia and aging processes.[21] The lower proportion observed in the 50–59-year group may relate to milder symptom burden, reduced healthcare-seeking behavior, and less frequent invasive diagnostic evaluation in this age range.[22] Clinical guidelines consistently indicate that symptoms in this group are often managed conservatively, with only a minority requiring surgical intervention such as TUR-P.[23] Meanwhile, the limited representation of patients aged ≥80 years in this study likely reflects the common clinical preference for conservative management in very elderly individuals because of higher perioperative risk and comorbidity burden.[24]

In the present study, APC was most frequently identified in the 60–69-year age group, which is concordant with population-based cancer registry data demonstrating that prostate cancer incidence peaks in older men, particularly those aged 65–74 years, with a median diagnostic age of approximately 68 years.[25,26] The presence of APC in the 50–59-year group, although limited, confirms that clinically significant carcinoma may still occur before the sixth decade. Conversely, the relatively lower proportion in the 70–79-year group does not necessarily indicate reduced biological risk but may reflect competing mortality, under-screening, or reduced diagnostic intervention in older populations.[26,27]

The present study was conducted in a type C hospital setting where routine PSA testing is not universally available, resulting in incomplete PSA data for a substantial proportion of patients. This limitation highlights an important systemic gap in diagnostic infrastructure that may affect the comprehensive evaluation of prostatic disease burden. Restricted PSA availability inevitably reduces the analytical power for assessing PSA–histopathology correlations and should therefore be interpreted cautiously when comparing with studies conducted in more resource-complete settings.

Therapy with 5-alpha reductase inhibitors is known to reduce serum PSA levels after several months by suppressing intraprostatic conversion of testosterone to dihydrotestosterone, despite persistence of glandular enlargement.[2] PSA is organ-specific rather than cancer-specific; therefore, elevated PSA levels may occur in both benign prostatic enlargement and malignant prostatic lesions.[9,23] In this study, BPH cases undergoing TUR-P represented clinically significant obstructive disease in patients for whom conservative and/or medical management had not provided adequate relief, or in whom surgery was clinically indicated. Previous medical therapy, including 5-alpha reductase inhibitor use when clinically indicated, was therefore a relevant clinical consideration in interpreting the PSA profile. Among the seven BPH cases with available PSA data, three had PSA levels ≤4.0 ng/mL, two had levels of 4.1–10 ng/mL, and two had PSA levels >10 ng/mL despite a histopathological diagnosis

of BPH. These findings show that the observed PSA distribution cannot be used in isolation to distinguish BPH from APC; histopathological evaluation remains necessary for definitive diagnosis.

All APC cases with available PSA data in this study showed PSA levels >10 ng/ml, supporting prior evidence that higher PSA levels correlate with increased tumor burden and risk of advanced disease.[28,29] Nevertheless, PSA remains an organ-specific rather than cancer-specific biomarker, and its interpretation must consider potential confounders such as prostatitis, instrumentation, or gland volume.[29,30] Despite these limitations, PSA continues to provide substantial clinical value in risk stratification, treatment monitoring, and early detection of biochemical recurrence.[31,32]

Ultrasonography remains widely used for initial evaluation of prostate enlargement; however, multiple studies have demonstrated only moderate concordance with histopathological findings. Reported sensitivity and specificity values indicate the potential for both false-positive and false-negative interpretations.[33–36] Consistently, grayscale TRUS alone shows limited diagnostic accuracy, although performance may improve with advanced multiparametric techniques.[37] Therefore, while ultrasonography is valuable for anatomical assessment and procedural guidance, tissue confirmation through biopsy remains indispensable for definitive diagnosis.[38] In the present study, ultrasonography data were available in 21 of 43 cases (48.84%). Among these cases, ultrasonographic diagnoses were concordant with histopathological findings in 15 of 18 BPH cases (83.33%) and 2 of 3 APC cases (66.67%), resulting in an overall observed concordance of 80.95%. Although the observed concordance was relatively high, these findings should be interpreted cautiously because ultrasonography data were unavailable in 22 cases (51.16%), and only three APC cases had available ultrasonographic examinations. Consequently, the apparently lower concordance observed in APC cannot be interpreted as evidence of poorer ultrasonographic performance in detecting malignant lesions.

In the diagnosis of APC, nuclear and nucleolar features are components of an integrated morphologic assessment rather than a sole discriminator between benign and malignant prostatic glands. In small or equivocal foci, the major criteria include an infiltrative growth pattern, nuclear atypia in the form of nuclear enlargement or macronuclei with prominent nucleoli, and absence of the basal-cell layer. Intraluminal blue mucin, pink amorphous secretions, crystalloids, amphophilic cytoplasm, and mitoses are supportive findings that increase diagnostic confidence when they accompany major criteria but cannot be used in isolation. Perineural invasion by atypical glands, glomerulations, and mucinous fibroplasia (*collagenous micronodules*) have high diagnostic specificity, although they may not be seen in small foci. Macronuclei may be inconspicuous in a small proportion of APC cases, whereas reactive or inflammatory changes may produce macronuclear or nucleolar changes in a small proportion of benign lesions.[39,40] In this study, the distribution of normonuclei in BPH and macronuclei in APC was recorded after

the histopathological diagnosis had been established through evaluation of all morphologic parameters. Therefore, Table 1 is not intended as a binary diagnostic rule that can be read in reverse: macronuclei alone do not establish APC, and normonuclei alone do not exclude APC. The presence of normonucleoli in two APC specimens further demonstrates that inconspicuous nucleoli do not preclude a diagnosis of APC. The absence of mitotic figures in this series likewise did not alter the classification because mitoses were not used as the basis for establishing the histopathological diagnosis.

Histopathologically, papillary infolding, cystic atrophy, tufting, micropapillary, and cribriform patterns are architectural descriptions rather than diagnostic synonyms. Papillary infolding and cystic atrophy support a benign lesion when they occur in preserved glandular architecture, without infiltrative growth, and with benign cytology. Conversely, tufting, micropapillary, or cribriform patterns must always be assessed in conjunction with the infiltrative pattern, luminal-cell cytology, and basal-cell layer; a cribriform pattern itself also requires distinction from HGPIN, intraductal carcinoma, and benign cribriform proliferations.[9,39] Gleason score/Grade Group is a grading system for invasive APC and is not applied to BPH, ASAP, or HGPIN.[12,13] In Table 1, the term *dominant glandular architecture* refers to a single pattern selected as the most representative pattern of the lesion determining the histopathological diagnosis in each specimen. This term does not imply that a specimen contains only one architectural pattern or that different patterns cannot coexist. In this study, papillary infolding and cystic atrophy were recorded as dominant patterns in BPH because they were identified in a non-infiltrative background, whereas tufting, micropapillary, and cribriform patterns were reported in APC after the invasive component fulfilled the morphologic criteria for malignancy. An APC specimen may still contain more than one architectural pattern, as well as non-neoplastic glands or BPH changes in the background. Accordingly, zero values in the table indicate only that the pattern was not recorded as the dominant pattern in that diagnostic category; they do not mean that the pattern cannot occur or lacks independent diagnostic significance. Because this study was designed from the outset to describe the spectrum of BPH, ASAP, HGPIN, and APC, Gleason score/Grade Group was not reported.

Corpora amylacea were predominantly identified in benign lesions, consistent with their well-documented association with aging prostates and BPH.[41] Their occasional presence in malignant glands, although uncommon, has been previously reported and may reflect degenerative or inflammatory microenvironmental changes.[42] Therefore, corpora amylacea should be interpreted as a supportive but non-specific feature in prostate pathology. Pink amorphous secretion was observed in both benign and malignant lesions, supporting prior reports that this finding reflects preserved secretory function and lacks discriminatory diagnostic value when interpreted in isolation.[9,41] In contrast, blue mucin and crystalloids were confined to

malignant cases in this study, consistent with their recognized association with prostatic adenocarcinoma.[39] Although not universally present, their identification may provide supportive morphologic evidence of malignancy when correlated with architectural and cytologic features.

Chronic non-specific inflammation was present in more than half of BPH cases, supporting the growing concept that BPH represents not merely a degenerative process but also an inflammation-driven proliferative condition.[21,24] Persistent inflammatory infiltrates are known to promote cytokine and growth factor signaling, which may stimulate stromal and epithelial hyperplasia. This inflammatory–proliferative axis likely contributes to progressive prostate enlargement observed in aging men. Squamous metaplasia identified in a subset of BPH cases likely represents an adaptive epithelial response to chronic irritation or inflammation.[39,41] Although benign and potentially reversible, this change may create diagnostic pitfalls if evaluated without careful morphologic correlation.

Urothelial carcinoma involving TUR-P material through secondary extension from the lower urinary tract is uncommon but well documented and has important clinical implications; meticulous histopathological examination of TUR-P tissue is therefore essential.[35,41] Signet-ring cell differentiation in prostatic adenocarcinoma is rare (approximately 0.5–2%), and extensive signet-ring cell differentiation has been associated with more aggressive biological behavior and poorer prognosis.[39,41] In this study, the incidental finding of urothelial carcinoma within a BPH specimen shows that TUR-P material submitted for symptomatic BPH may contain another clinically relevant lesion. Likewise, the APC case with focal signet-ring cell feature is interpreted as a manifestation of histological heterogeneity; its focal nature should not be equated with extensive signet-ring cell differentiation.

LIMITATIONS AND STRENGTHS OF THE STUDY

This study has several limitations that should be considered in interpreting the findings. It uses a descriptive design without inferential analysis, involves a modest sample size from a single center, and contains incomplete PSA and ultrasonography data in a subset of cases because of real-world resource limitations in a type C hospital setting. These constraints may reduce the generalizability of the results and limit more comprehensive clinicopathological correlation. Nevertheless, this study also has important strengths, including the provision of institution-specific Indonesian data that remain limited in the literature, the emphasis on clinicohistopathological correlation and routine diagnostic pitfalls in daily practice, and the use of standardized histopathological review with clear descriptive reporting.

CONCLUSION

BPH is the most prevalent prostatic lesion evaluated at Rumah Sakit Pendidikan Prof. dr. Chairuddin Panusunan Lubis, followed by APC, whereas ASAP and precursor lesions such as HGPIN were not identified. The most affected age group for both benign and malignant lesions

is 60–69 years. Among APC cases with available PSA data, all three had PSA levels >10 ng/mL; however, elevated PSA was also observed in two BPH cases, indicating that PSA elevation is not specific for malignancy. Among cases with available ultrasonography, concordance with histopathological diagnosis was observed in 15 of 18 BPH cases (83.33%) and in 2 of 3 APC cases (66.67%); these descriptive proportions should be interpreted in the context of incomplete ultrasonography availability. Histopathologically, BPH is characterized by a dominant glandular architecture of papillary infolding and cystic atrophy with intraluminal corpora amylacea. In contrast, APC predominantly exhibits tufting, cribriform, and micropapillary glandular architectures, accompanied by intraluminal blue mucin and crystalloids.

IMPLICATIONS AND RECOMMENDATIONS

These findings underscore the need to improve access to key diagnostic modalities, particularly PSA testing and ultrasonography, as limited availability resulted in incomplete data in a substantial proportion of cases. Future studies with longer duration and larger sample sizes are warranted to provide more representative clinicohistopathological profiles and to enhance understanding of clinical and histomorphological variation in prostatic lesions. Prospective studies should preferably be undertaken in hospitals with routinely available and standardized PSA and ultrasonography services so that clinicoradiological variables can be recorded more completely and interpreted with greater accuracy.

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Conflict of Interest

The authors declare no competing interests in this study.

Author Contributions

All authors contributed equally to the planning, data collection, clinical analysis, and drafting and revising of the article. Histomorphological examination was performed by LIL, CTM and AWH. All authors have read and approved the final draft of this article.

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REFERENCES

1. Speakman MJ, Cheng X, Kirby RS, Novara G, Wolff JM. The Global, Regional, and National Burden of Benign Prostatic Hyperplasia in 204 Countries and Territories: A Systematic Analysis for the Global Burden of Disease Study 2019. *Lancet Heal Longev*. 2022;3(11):e754–e776. doi:10.1016/S2666-7568(22)00213-6
2. Ng M, Lynch J. Benign Prostatic Hyperplasia. In: *StatPearls*. Treasure Island, FL: StatPearls Publishing; 2024. https://www.ncbi.nlm.nih.gov/books/NBK558920/. Accessed January 26, 2026.
3. Chen X, Li Y, Zhang Q, Wang Y, Liu Z. Global, Regional, and National Burden of Benign Prostatic Hyperplasia, 1990–2019: A Systematic Analysis. *Sci Rep*. 2025;15:90229. doi:10.1038/s41598-025-90229-3

4. Ye Z, Wang Y, Wang S, Hu H, Zhang X. Global Burden of Benign Prostatic Hyperplasia in Males: An Analysis Based on the Global Burden of Disease Study 2019. *BMC Urol*. 2024;24:158. doi:10.1186/s12894-024-01582-w

5. Ikatan Ahli Urologi Indonesia. Panduan Praktik Klinis Pembesaran Prostat Jinak (Benign Prostatic Hyperplasia). 2021. Available from: https://iaui.or.id/uploads/guidelines/2021_PPK_PEMBESARAN_PROSTAT_JINAK_BPH.pdf. Accessed January 26, 2026.

6. Raharjo RA, Mochtar CA, Umbas R. Diagnosis and Treatment Patterns of Male Lower Urinary Tract Symptoms Suggestive of Benign Prostatic Hyperplasia in Asia. *Ther Adv Urol*. 2016;8(6):371-383. doi:10.1177/1756287216665893

7. Guo Z, Zhu S, Wu J, Liu X, Xu T. Prevalence and Risk Factors for Incidental Prostate Cancer in Patients After Transurethral Resection of the Prostate with Negative Results on Prostate Biopsy: A Retrospective Study. *Int Brazilian J Urol*. 2022;48(6):1015-1026. https://pmc.ncbi.nlm.nih.gov/articles/PMC8902422/. Accessed January 26, 2026.

8. Janjua TK, Iqbal MS, Rasheed H, Akhter S, Iqbal Z. Incidental Finding of Prostate Cancer in Transurethral Resection of Prostate (TURP) Specimens: A Retrospective Analysis from a Tertiary Care Hospital in Pakistan. *Pan Afr Med J*. 2021;39:20. https://pmc.ncbi.nlm.nih.gov/articles/PMC8348362/. Accessed January 26, 2026.

9. Xu Y, Che W, Zhang Q, Wang J, Gao Y. The Benign Mimickers of Prostatic Acinar Adenocarcinoma. *Transl Androl Urol*. 2016;5(1):23-32. doi:10.3978/j.issn.2223-4683.2016.01.02

10. Tsampoukas G, Zafeiriou Z, Aggelakis S, Karyotis I, Deliveliotis C. Atypical Small Acinar Proliferation and Its Significance in Pathological Reports in Modern Urological Times. *J Clin Med*. 2021;11(2):248. doi:10.3390/jcm11020248

11. Leone A, Gershman B, Rotker K, Butler C, Fantasia J, Miller A. Atypical Small Acinar Proliferation (ASAP): Is a Repeat Biopsy Necessary? A Multi-Institutional Review. *Prostate Cancer Prostatic Dis*. 2016;19(1):68-71. doi:10.1038/pcan.2015.53

12. Iczkowski KA, DeMarzo AM, Agarwal N, et al. International Society of Urological Pathology Consensus on Cancer Precursor Lesions. Working Group 1: The Prostate. *Am J Surg Pathol*. 2025;49(12):e33–e45. doi:10.1097/PAS.0000000000002430

13. Surintrspanont J, Klotz L, Epstein JI, Netto GJ, Magi-Galluzzi C. Prostate Pathology: What is New in the 2022 WHO Classification. *Cancers (Basel)*. 2023;15(14):3621. doi:10.3390/cancers15143621

14. Sung H, Ferlay J, Siegel RL, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin*. 2021;71(3):209-249. doi:10.3322/caac.21660

15. Wang Z, Lu S, He Y, Wang Y, Wang L, Du L. Prostate Cancer Incidence and Mortality: Global Status and Temporal Trends in 89 Countries from 2000 to 2019. *Front Public Heal*. 2022;10:811044. doi:10.3389/fpubh.2022.811044

16. Global Cancer Observatory. United States of America Fact Sheet (GLOBOCAN 2022). 2024. https://gco.iarc.who.int/media/globocan/factsheets/populations/840-united-states-of-america-fact-sheet.pdf. Accessed January 26, 2026.

17. Global Cancer Observatory. Europe Fact Sheet (GLOBOCAN 2022). 2024. https://gco.iarc.who.int/media/globocan/factsheets/populations/908-europe-fact-sheet.pdf. Accessed January 26, 2026.

18. Eala MA, Dee EC, Jacomina LE, et al. Prostate Cancer in Southeast Asia: An Analysis of 2022 Incidence and Mortality Data. *Int J Radiat Oncol Biol Phys*. 2024;120(2 Suppl):e528. doi:10.1016/j.ijrobp.2024.07.1170

19. Kristiana T, Dewi IGASM, Maker LPII, Saputra H, Sriwidyani NP, Muliarta IM. Loss of Phosphatase and Tensin Homologue (PTEN) Expression Associated with Higher Risk Grade Group Gleason Prostate Adenocarcinoma in Sanglah Hospital Denpasar. *Indones J Cancer*. 2019;13(4):127-132. doi:10.33371/ijoc.v13i4.680

20. Wei H, Zhu C, Huang Q, et al. Global, Regional, and National Burden of Benign Prostatic Hyperplasia from 1990 to 2021 and Projection to 2035. *BMC Urol*. 2025;25(1):34. doi:10.1186/s12894-025-01715-9

21. Lim KB. Epidemiology of Clinical Benign Prostatic Hyperplasia. *Asian J Urol*. 2017;4(3):148-151. https://pmc.ncbi.nlm.nih.gov/articles/PMC5717991/. Accessed January 26, 2026.

22. Sandhu JS, Bixler BR, Dahm P, et al. Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia (BPH): AUA Guideline Amendment 2023. *J Urol*. 2024;211(1):11-19. doi:10.1097/JU.0000000000003698

23. Gravas S, Cornu JN, Gacci M, et al. Management of Non-Neurogenic Male Lower Urinary Tract Symptoms (LUTS), Including Benign Prostatic Obstruction (BPO): EAU Guidelines 2023. *Eur Urol*. 2023;84(1):64-85. https://www.europeanurology.com/article/S0302-2838(23)02731-8/fulltext. Accessed January 26, 2026.

24. Vuichoud C, Loughlin KR. Benign Prostatic Hyperplasia: Epidemiology, Economics and Evaluation. *Can J Urol*. 2015;22(Suppl 1):1-6. https://www.canjurol.com/html/free-articles/JUV22I5S1F_06_DrLoughlin.pdf. Accessed January 26, 2026.

25. National Cancer Institute. Cancer Stat Facts: Prostate Cancer. 2026. https://seer.cancer.gov/statfacts/html/prost.html. Accessed January 26, 2026.

26. Centers for Disease Control and Prevention. Prostate Cancer Incidence. 2026. https://www.cdc.gov/united-states-cancer-statistics/publications/prostate-cancer.html. Accessed January 26, 2026.

27. de Vos II, Remmers S, Hogenhout R, Roobol MJ, Group ERS. Prostate Cancer Mortality Among Elderly Men After Discontinuing Organised Screening: Long-term Results from the European Randomized Study of Screening for Prostate Cancer Rotterdam. *Eur Urol*. 2024;85(1):74-81. doi:10.1016/j.eururo.2023.10.011

28. European Association of Urology. EAU Guidelines on Prostate Cancer: Classification and Staging Systems (Risk Groups; PSA Cut-offs). 2026. https://uroweb.org/guidelines/prostate-cancer/chapter/classification-and-staging-systems. Accessed January 26, 2026.

29. Luining WI, Brouwer OR, DeJong J, Van Leeuwen PJ, Donswijk ML, Meijer D. The Probability of Metastases Within Different Prostate-Specific Antigen Levels in Patients Undergoing PSMA PET/CT for Primary Staging of Prostate Cancer. *Eur Urol Open Sci*. 2023. https://pmc.ncbi.nlm.nih.gov/articles/PMC10829602/. Accessed January 26, 2026.

30. National Cancer Institute. Prostate-Specific Antigen (PSA) Test. 2026. https://www.cancer.gov/types/prostate/psa-fact-sheet. Accessed January 26, 2026.

31. American Urological Association, Society of Urologic Oncology. Early Detection of Prostate Cancer: AUA/SUO Guideline (2023). 2023. https://www.auanet.org/guidelines-and-quality/guidelines/early-detection-of-prostate-cancer. Accessed January 26, 2026.

32. American Urological Association, Society of Urologic Oncology. Advanced Prostate Cancer: AUA/SUO Guideline. 2026. https://www.auanet.org/guidelines-and-quality/guidelines/advanced-prostate-cancer. Accessed January 26, 2026.

33. David MK, Leslie SW. Prostate-Specific Antigen. In: *StatPearls*. Treasure Island, FL: StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK557495/. Accessed January 26, 2026.

34. European Association of Urology. EAU Guidelines on Prostate Cancer: Diagnostic Evaluation. 2026.

https://uroweb.org/guidelines/prostate-cancer/chapter/diagnostic-evaluation. Accessed January 26, 2026.

35. Descotes JL. Diagnosis of Prostate Cancer. *Asian J Urol*. 2019;6(2):129-136. doi:10.1016/j.ajur.2018.11.007
36. Shareef S, Joshi A. Effectiveness of Transabdominal Ultrasonography in Assessing Benign versus Malignant Nature of Prostatomegaly. *Int J Res Med Sci*. 2019;7(6):2297-2301. https://www.msjonline.org/index.php/ijrms/article/download/6488/4819/25814. Accessed January 26, 2026.
37. Jawli A, Huang Z, Almansour H, Ahmed HU, Sidhu HS. The Performance of Different Parametric Ultrasounds in Prostate Cancer Diagnosis: Correlation with Radical Prostatectomy Specimens. *Diagnostics*. 2024;14(8).
38. McNally CJ, Ruddock MW, Moore T, McKenna DJ. Biomarkers That Differentiate Benign Prostatic Hyperplasia from Prostate Cancer: A Literature Review. *Cancer Manag Res*. 2020;12:5225-5241.
39. Humphrey PA. Histopathology of Prostate Cancer. *Cold Spring Harb Perspect Med*. 2017;7(10):a030411. doi:10.1101/cshperspect.a030411
40. Guo CC, Czerniak B. Updates of Prostate Cancer from the 2022 World Health Organization Classification of the Urinary and Male Genital Tumors. *J Clin Transl Pathol*. 2023;3(1):26-34. doi:10.14218/JCTP.2022.00029
41. Magi-Galluzzi C. Prostate Cancer: Diagnostic Criteria and Role of Immunohistochemistry. *Mod Pathol*. 2018;31(Suppl 1):12-21. doi:10.1038/modpathol.2017.139
42. DuPre NC, Wang A, Nelson HH, et al. Corpora Amylacea in Prostatectomy Tissue and Associations with Molecular, Histological, and Lifestyle Factors. *Prostate*. 2018;78(15):1172-1180. doi:10.1002/pros.23692