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Original Article

Early Diagnosis Challenges and Histoprognostics of Prostate Cancer in Burkina Faso: A 10-Year Study of 1,572 Cases

Défis du Diagnostic Précoce et Facteurs Histoprognostiques du Cancer de la Prostate Au Burkina Faso : Étude de 1 572 Cas sur 10 ans

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Key Words: prostate; cancer; histoprognostic factors; digital rectal examination; tPSA; Gleason; ISUP; Burkina Faso

Mots clés : prostate ; cancer ; facteurs histoprognostiques ; toucher rectal ; PSAt ; Gleason ; ISUP ; Burkina Faso.

ABSTRACT

Introduction. Prostate cancer is a growing public health issue in Africa. This study aimed to describe the histo-epidemiological characteristics, evaluate histoprognostic factors, and identify the primary drivers of diagnostic delay in prostate cancers diagnosed in Burkina Faso between 2014 and 2023. **Methods.** A descriptive and analytical cross-sectional study with retrospective data collection was conducted across all pathology laboratories in Burkina Faso. Statistical analysis utilized Student's t-test, Fisher's exact test, Pearson's chi-square test, Cramér's V, and Spearman's rank correlation ($p < 0.05$). **Results.** Over a ten-year period, 3,994 prostate specimens were analyzed across anatomical pathology laboratories in Burkina Faso. Prostate cancer was identified in 1,572 cases, including 1,501 primary malignancies (prevalence: 37.58%; mean: 150.1 cases/year). The mean patient age was 70.11 ± 8.33 years. Mean total PSA (tPSA) level was 410.88 ng/mL, with 92.55% of patients presenting with levels ≥ 10 ng/mL. Acinar adenocarcinoma was the predominant histological subtype (98.34%). Gleason score 7 (46.43%) and ISUP grade group 1 (31.68%) were the most frequent. Perineural invasion, lymphovascular invasion, high-grade prostatic intraepithelial neoplasia (HGPIN) lesions, and periprostatic adipose tissue infiltration were observed in 35.75%, 7.50%, 9.75%, and 26.25% of cases, respectively. The association between digital rectal examination (DRE) findings and Gleason score was statistically significant ($p = 0.0002$, Cramér's V = 0.3011). The correlation coefficient (rho) between tPSA and Gleason score was 0.32**. Conclusion.** Prostate cancer in Burkina Faso is characterized by diagnosis at an advanced stage. Implementing targeted screening protocols along with binary and standardized histopathological reporting represent key priorities to optimize patient management.

RÉSUMÉ

Introduction. Le cancer de la prostate constitue un problème de santé publique croissant en Afrique. Cette étude visait à décrire les caractéristiques histo-épidémiologiques, à évaluer les facteurs histoprognostiques et à identifier les principaux facteurs de retard diagnostique des cancers de la prostate diagnostiqués au Burkina Faso entre 2014 et 2023. **Méthodes.** Une étude transversale descriptive et analytique avec collecte rétrospective des données a été menée dans l'ensemble des laboratoires d'anatomie pathologique du Burkina Faso. L'analyse statistique a utilisé le test t de Student, le test exact de Fisher, le test du chi carré de Pearson, le V de Cramér et la corrélation de rang de Spearman ($p < 0,05$). **Résultats.** Sur une période de dix ans, 3 994 prééléments prostatiques ont été analysés dans les laboratoires d'anatomie pathologique du Burkina Faso. Un cancer de la prostate a été identifié dans 1 572 cas, dont 1 501 tumeurs malignes primitives (prévalence : 37,58 % ; moyenne : 150,1 cas/an). L'âge moyen des patients était de 70,11 ± 8,33 ans. Le taux moyen de PSA total (PSAt) était de 410,88 ng/mL, avec 92,55 % des patients présentant des taux ≥ 10 ng/mL. L'adénocarcinome acinaire était le sous-type histologique prédominant (98,34 %). Le score de Gleason 7 (46,43 %) et le groupe grade ISUP 1 (31,68 %) étaient les plus fréquents. Des engainements périneuraux, des emboles vasculaires, des lésions de néoplasie intraépithéliale prostatique de haut grade (PINHG) et une infiltration du tissu adipeux périprostatique ont été observés dans 35,75 %, 7,50 %, 9,75 % et 26,25 % des cas, respectivement. L'association entre les données du toucher rectal (TR) et le score de Gleason était statistiquement significative ($p = 0,0002$, V de Cramér = 0,3011). Le coefficient de corrélation (rho) entre le PSAt et le score de Gleason était de 0,32. **Conclusion.** Le cancer de la prostate au Burkina Faso se caractérise par un diagnostic à un stade avancé. La mise en œuvre de protocoles de dépistage ciblé ainsi qu'un compte rendu histopathologique binaire et standardisé représentent des priorités clés pour optimiser la prise en charge des patients.

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HIGHLIGHTS

What is known about the subject. Prostate cancer is a growing public health issue in Africa.

The question addressed in this study. A 10-year retrospective cross-sectional study was conducted across all pathology laboratories in Burkina Faso to analyze the histo-epidemiological profile, histoprognostic factors, and drivers of diagnostic delay in 1,572 prostate cancer cases.

What this study adds to our knowledge. Among 1,572 prostate cancer cases (prevalence: 37.58%, mean age: 70.1 years), acinar adenocarcinoma predominated (98.34%), with 92.55% presenting with elevated tPSA (≥10 ng/mL) and significant correlations between Gleason score, digital rectal examination, and tPSA levels.

Implication for practice. Implementing targeted early-screening protocols and standardized, binary histopathological reporting is essential to mitigate diagnostic delay and optimize prostate cancer management in Burkina Faso.

ABBREVIATIONS

ACP: Anatomic and Cytological Pathology; ADK: Adenocarcinoma; CT: Computed tomography; DRE: Digital rectal examination; ISUP: International Society of Urological Pathology; LUTS: Lower urinary tract symptoms; MRI: Magnetic resonance imaging; PIN: Prostatic intraepithelial neoplasia; PSA: Prostate-specific antigen; pTNM: Pathological tumor-node-metastasis stage; TURP: Transurethral resection of the prostate.

INTRODUCTION

Prostate malignancies are diseases of the elderly population and represent a major public health concern [1]. According to GLOBOCAN 2022 global estimates, prostate cancer is the second most common cancer in men worldwide and the fifth leading cause of cancer mortality, accounting for approximately 1.47 million new cases and 397,000 deaths [2]. In Europe and the United States, its incidence increased over a long period due to early opportunistic screening using total PSA (tPSA) testing [3]. In Africa, it is the leading cancer among men (20.4%) and the third most common cancer across both sexes (8.7%), with an estimated mortality rate of 7.3% [4]. This mortality rate in Africa is proportionally higher than in countries with a high Human Development Index, reflecting diagnosis at a more advanced stage [2]. The adoption of a Western lifestyle and underlying genetic factors have been proposed to explain this rising burden [5, 6]. Its prognosis relies heavily on the ISUP grade group, derived from the Gleason score.

In Burkina Faso, Zongo et al. (1998-2018) had already ranked this malignancy second after breast cancer, with adenocarcinoma accounting for 92.33% of cases [7]. At a more local level, Ido et al. reported 717 cases compiled across five laboratories in Ouagadougou between 2007 and 2015 (annual incidence: 79.66 cases). However, histoprognostic evaluation in their series was limited to the ISUP grade group and Gleason score [8]. To date, no nationwide study has comprehensively examined both the exhaustive morphological spectrum and the full array of histoprognostic factors of prostate cancer.

The objective of this study was to describe the histo-epidemiological characteristics and analyze the histoprognostic factors of prostate cancers diagnosed in Burkina Faso between 2014 and 2023, along with their anatomo-clinical and anatomo-biological correlations, while identifying the main factors contributing to diagnostic delay in our setting.

METHODOLOGY

Study Design and Period

This was a descriptive and analytical cross-sectional study of a prostate cancer case series. Data collection was performed retrospectively, covering a 10-year period from January 1, 2014, to December 31, 2023.

Study Setting

The study was conducted across all anatomical pathology departments in Burkina Faso. These included five (5) University Teaching Hospitals (Yalgado Ouedraogo University Teaching Hospital, Tengandogo University Teaching Hospital, and Bogodogo University Teaching Hospital in Ouagadougou; Sourô Sanou University Teaching Hospital in Bobo-Dioulasso; and Ouahigouya Regional University Teaching Hospital), three (3) faith-based hospitals (Saint Camille Hospital of Ouagadougou, Paul VI Hospital, and Schiphra Protestant Hospital), and six (6) private pathology laboratories (Sandof Polyclinic, Philadelphie Polyclinic, Wendtoin Clinic, and Ilboudo Bruno Clinic in Ouagadougou; Universelle du Houet Clinic and Lorentia Clinic in Bobo-Dioulasso).

Selection Criteria

Sampling was systematic and included all histologically confirmed prostate cancer cases recorded in anatomical pathology laboratories during the study period that possessed a complete, legible, and usable histopathological report. Duplicate entries and incomplete reports were excluded. For the analysis of histoprognostic factors, radical prostatectomy specimens were included if the corresponding patients had a prior diagnostic biopsy on record.

Study Population and Variables

Data collection was performed from archived reports across the collection sites using a standardized digital questionnaire deployed on smartphones. The study population comprised all patients with a histologically confirmed diagnosis of prostate cancer in anatomical pathology laboratories in Burkina Faso during the study period.

The variables collected included patient age, clinical presentation, digital rectal examination (DRE) and medical imaging findings, total PSA (tPSA) level, specimen type, histological subtype, percentage of high-grade disease, Gleason score, ISUP grade group, perineural invasion, lymphovascular invasion, periprostatic adipose tissue involvement, high-grade prostatic intraepithelial neoplasia (HGPIN) lesions, surgical margin status, lymph node status on radical prostatectomy specimens, and pTNM pathological stage.

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Data Processing and Statistical Analysis

Data gathered via the smartphone-deployed digital questionnaire were exported in XLS format and analyzed using Microsoft Excel and Epi Info statistical software (version 7.2.5.0). Continuous variables were compared using Student's t-test and Fisher's exact test. Pearson's chi-square test was used to compare proportions. Cramér's V coefficient and Spearman's rank correlation coefficient (rho) were calculated to assess anatomo-clinical and anatomo-biological correlations. Ninety-five percent confidence intervals (95% CI) were calculated, and statistical significance was set at $p < 0.05$.

Ethical Considerations

Data retrieval across participating laboratories was conducted following formal authorization from hospital directors and pathology laboratory heads. This study complied with ethical guidelines established by the institutional review board. Patient anonymity and data confidentiality were strictly maintained throughout data collection and analysis.

RESULTS

Epidemiological Data

Between January 1, 2014, and December 31, 2023, a total of 3,994 prostate tissue specimens were analyzed across anatomical pathology laboratories in Burkina Faso. A diagnosis of prostate cancer, including all histological subtypes, was established in 1,572 of these specimens, with 1,501 representing primary prostatic malignancies. The prevalence of primary prostate cancer was 37.58%, with a mean annual frequency of 150.1 cases.

Table I : Annual number of prostate cancer cases per 5,000 men aged over 50 years.

Year	Number of cancer cases	Total number of cancer cases s	Men aged 50 and over	Cancer incidence rate per population	Number of cancer cases per 5,000 inhabitants
2014	140	140	719 541	5 140	1
2015	60	200	739 044	3 695	1
2016	91	291	759 337	2 609	2
2017	101	392	780 501	1 991	3
2018	165	557	803 346	1 442	3
2019	118	675	939 517	1 392	4
2020	195	870	896 736	1 031	5
2021	209	1079	915 609	849	6
2022	168	1247	936 063	751	7
2023	325	1572	958 189	610	**8**

The average age of the patients was 70.11 ± 8.33 years, ranging from 28 to 94 years. Figure 1 shows the numbers of patients by age group.

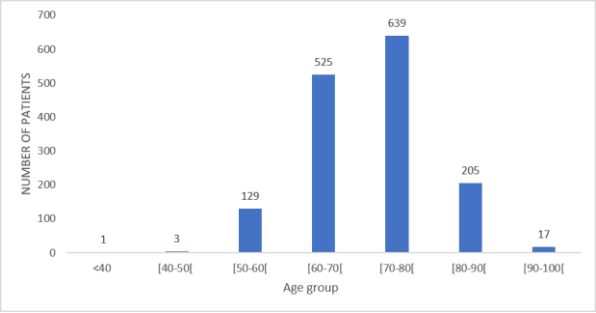

Figure 1: Breakdown of patients by age group (n=1,519)

Clinical and Paraclinical Data

Clinical symptomatology was specified in 112 patients (7.37%). Presentation included hematuria and urinary retention features (isolated or combined) in 59.8%, lower urinary tract symptoms (LUTS) in 31.2%, or isolated hematuria in 4.5%.

Digital rectal examination (DRE) findings were provided to the pathologist in 737 cases (48.51%). DRE findings raised suspicion of malignancy in 44.6% of cases, suggested benign disease in 19.9%, and were non-inconclusive in 35.6% of cases.

Imaging modalities included ultrasonography, CT, MRI, or combined CT and MRI. Imaging data were recorded on the pathology request forms for 253 patients (16.1%), with features suggestive of malignancy reported in 21% of cases.

Numerical total PSA (tPSA) values were reported for 1,242 patients (81.76%). Table II details the frequency and distribution of cases across tPSA value ranges.

Table II: Case distribution by total PSA (tPSA) value range (N=1242)

PSAt rate	Workforce	%
< 4	8	0,65
[4-10[	84	6,8
[10-20[	111	08,95
[20-30[	95	07,6
[30-100[	369	29,7
[100-200[	133	10,7
[200-300[	62	05
[300-1000[	180	14,5
≥1000	200	16,10
Total	1242	100,00

Morphological Data

All types of prostate tissue specimens were received across the laboratories.

Histopathological examination identified three major tumor categories based on the proliferating cellular lineage. These comprised 1,499 cases of epithelial malignancies (98.68%), two cases of primary prostatic mesenchymal malignancies (0.13%), and 18 cases of urinary tract malignancies with contiguous extension to the prostate (1.13%). Table III summarizes the distribution of the various histological subtypes according to specimen type.

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Table III: Distribution of histological subtypes according to specimen type.

Types histologiques	Biopsy	Adenomectomy	TRUP	Bladder neck and prostatic resection	Radical prostatectomy	Radical cystoprostatectomy	Total
Acinar ADK	1287	117	50	36	52	4	1546
Ductal ADK	1	0	0	0	0	0	1
Basal cell carcinoma	2	0	0	0	0	0	2
Intraductal Carcinoma	2	0	0	0	0	1	3
urothelial Carcinoma	0	3	1	0	1	4	9
Squamous cell carcinoma	1	1	2	0	0	5	9
Leiomyosarcoma	2	0	0	0	0	0	2
Total	1295	121	53	36	53	14	1572

Histoprognostic Factors

- **Gleason Score (n = 1,463)**

The Gleason score applies to acinar and ductal adenocarcinomas. Together, these two entities comprised 1,547 cases. Histopathological reports documented the Gleason score in 1,458 cases, representing 94.25% of these tumors. Table IV details the distribution of Gleason scores.

Table IV: Gleason score distribution in prostatic adenocarcinomas.

Type histo	6 (3+3)	7 (3+4)	7 (4+3)	8 (3+5)	8 (4+4)	8 (5+3)	9 (4+5)	9 (5+4)	10 (5+5)	Total
Acinar ADK	461	317	360	3	264	3	26	16	7	1457
Ductal ADK	1	0	0	0	0	0	0	0	0	1
Total	462	317	360	3	264	3	26	16	7	1458

ADK : adenocarcinoma

- **ISUP Grade Group**

The ISUP grade group applies to prostatic adenocarcinomas diagnosed on biopsy. A total of 1,295 core needle biopsies were retrieved, including two cases of basal cell carcinoma, two cases of intraductal carcinoma, one case of squamous cell carcinoma, and two leiomyosarcomas. Biopsies yielding a diagnosis of prostatic adenocarcinoma thus numbered 1,288. Among these 1,288 cases, the ISUP grade group was documented in 875 cases (67.93%). Figure 2 shows an image of an acinar adenocarcinoma with scores of 3 and 4.

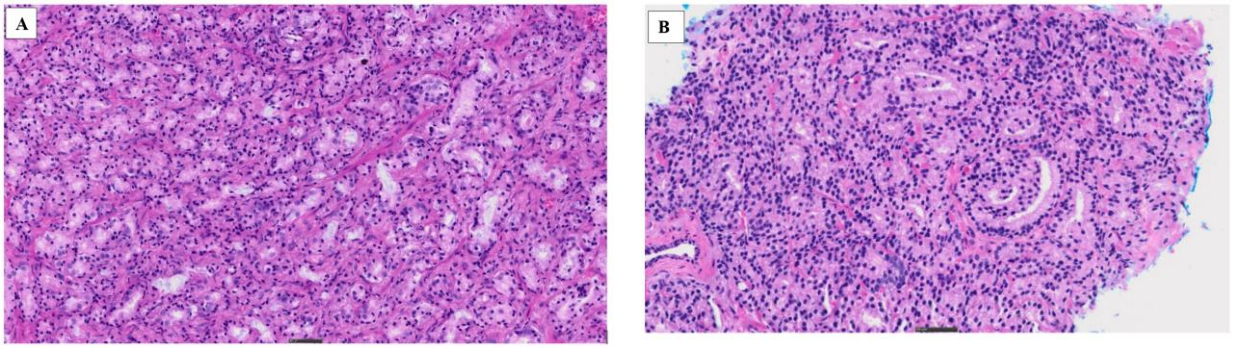

Figure 2. Acinar adenocarcinoma of the prostate (Hematoxylin-eosin stain, original magnification ×40). (A) Well-formed tumourous prostate glands, separated by connective tissue (Gleason score 3)**. (B)** Prostate glands that are sometimes well-formed and adjacent, and sometimes fused Gleason score 3 and 4). **Source:** Department of Pathology, Tengandogo University Hospital, Ouagadougou, Burkina Faso.

- **Tumor Size and Number of Tumor Foci (n = 153)**

Histopathological reports specified the number of tumor-involved biopsy cores in 153 cases (11.81%).

- **Quantification of High-Grade Disease (Grades 4 and 5)**

The presence of high-grade disease (Gleason pattern 4 or 5) was reported in 6.20% of pathology reports, varying according to specimen type: 9.60% on biopsy, 6.00% on TURP, 1.20% on simple prostatectomy (adenomectomy), and 8.00% on radical

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prostatectomy specimens. The number and/or extent of tumor foci was reported in 153 cases (11.81%). Figure 3 shows high grade appearance.

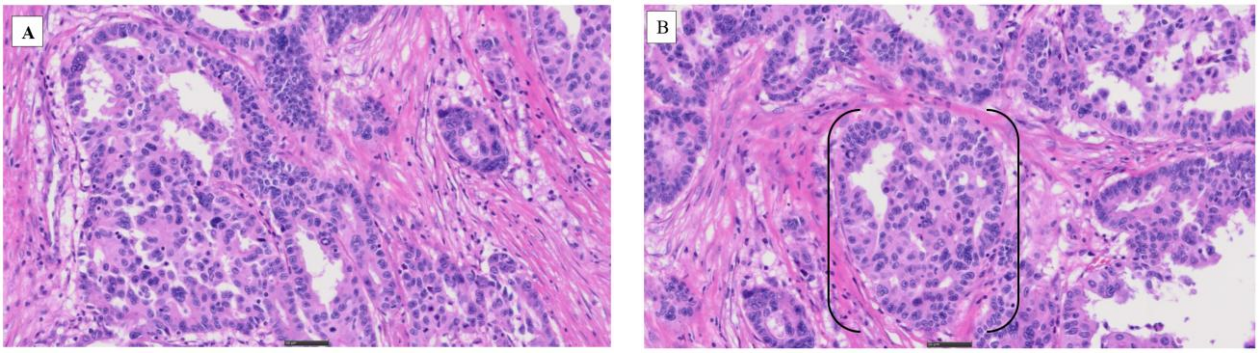

Figure 3: Acinar adenocarcinoma of the prostate (Hematoxylin-eosin stain, original magnification ×100). (A): fused glands and masses; **(B):** Glomeruloid appearance in the centre. **Source**: Department of Pathology, Tengandogo University Hospital, Ouagadougou, Burkina Faso.

- **Perineural Invasion**

Perineural invasion status was recorded in 70.75% of pathology reports and was present in 35.75% of cases. Microphotograph 4 shows an example of perineural sheathing.

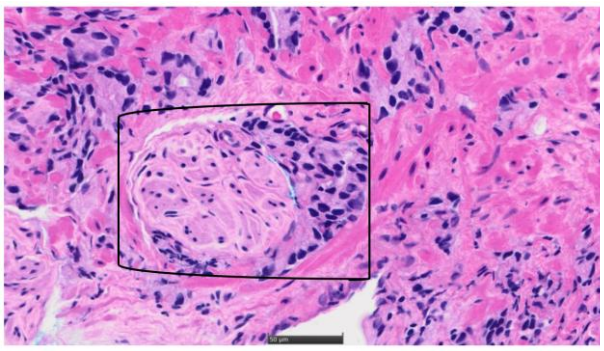

Figure 4. Perineural invasion within an acinar adenocarcinoma of the prostate (Hematoxylin-eosin stain, original magnification ×100). A nerve trunk is semi circumferentially surrounded by neoplastic glandular structures. Source: Department of Pathology, Tengandogo University Hospital, Ouagadougou, Burkina Faso

- **Lymphovascular Invasion**

Lymphovascular invasion was addressed in approximately 41.00% of pathology reports and was identified in 7.50% of cases.

- **High-Grade Prostatic Intraepithelial Neoplasia (HGPIN)**

The presence or absence of high-grade prostatic intraepithelial neoplasia (HGPIN) was mentioned in 12.75% of pathology reports, with lesions observed in 9.75% of cases.

- **Periprostatic Adipose Tissue Infiltration (Microphotograph 5)**

Periprostatic adipose tissue involvement was documented in 38.75% of pathology reports and was identified in 26.25% of cases.

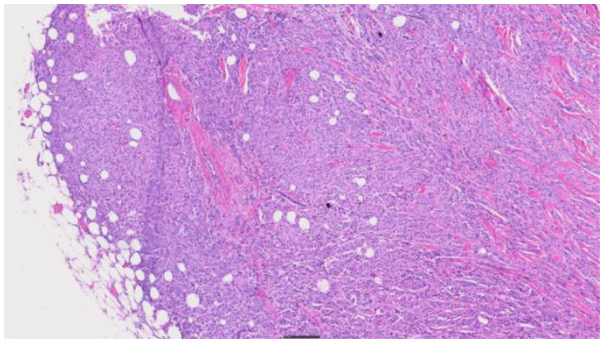

Figure 5. Acinar adenocarcinoma of the prostate (Hematoxylin-eosin stain, original magnification ×10). The tumour is invading the periprostatic adipose tissue. Source: Department of Pathology, Tengandogo University Hospital, Ouagadougou, Burkina Faso

- **Specific Histoprognostic Factors for Radical Prostatectomy Specimens (n = 53)**

These factors comprise surgical margin status, invasion of the bladder neck, apex, base, and seminal vesicles, as well as lymph node involvement. The distribution of these specific histoprognostic factors is illustrated in Figure 6.

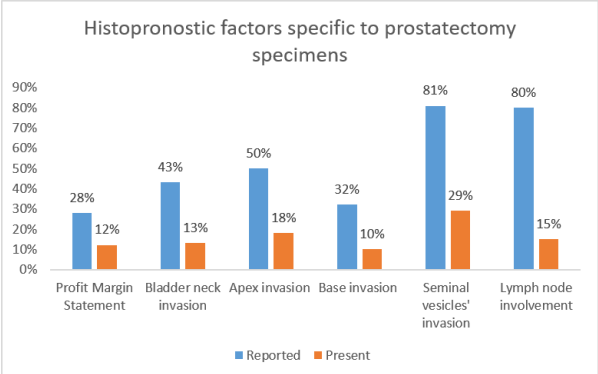

Figure 6: Distribution of specific histoprognostic factors on radical prostatectomy specimens

- **pTNM Classification**

The pTNM stage was documented in 10.20% of transurethral resection of the prostate (TURP) chips, 16.00% of simple prostatectomy (adenomectomy) specimens, and 84.40% of radical prostatectomy

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specimens. These stages comprised pT1-2N0M0, pT3-4N0-N1Mx, and pT1-4N0-1M1.

- **Anatomo-Clinical and Anatomo-Biological Correlations**

A statistically significant association was identified between digital rectal examination (DRE) findings and the Gleason score (p = 0.0002, Cramér's V = 0.3011), reflecting a moderate strength of association. Furthermore, a moderate positive correlation was observed between total PSA (tPSA) levels and the Gleason score (rho = 0.32).

DISCUSSION

Epidemiological Data

This multicenter study, representing the largest national series reported to date, compiled 1,572 cases of prostate cancer in Burkina Faso over a 10-year period, with a prevalence of 38.26% (37.58% for primary prostate malignancies) and a mean annual frequency of 150.1 cases, steadily increasing from 140 cases in 2014 to 325 cases in 2023. Compared with the 717 cases reported by Ido et al. across five pathology laboratories in Ouagadougou between 2007 and 2015 (annual incidence: 79.66 cases) (8), our series demonstrates a marked increase, which can be attributed to two main factors. First, this is the first study encompassing all anatomical pathology laboratories nationwide, whereas previous series were restricted to a few institutions in the capital. Second, the nationwide pathology network expanded significantly during the study period: between 2014 and 2016, only the laboratories at Yalgado Ouédraogo University Teaching Hospital, Philadelphie and Sandof Polyclinics, Schiphra Protestant Hospital in Ouagadougou, and Sourô Sanou University Teaching Hospital in Bobo-Dioulasso were operational. The pathology departments at Tengandogo University Teaching Hospital and Bogodogo University Teaching Hospital opened in 2017 and 2018, respectively, while the Ouahigouya department was established in 2017 and became fully functional in 2018. This structural decentralization mechanically broadened access to histopathological diagnosis, thus cautioning against interpreting this upward trend solely as a true rise in disease incidence.

The mean age at diagnosis (70.11 ± 8.33 years) is comparable to findings reported in other African series, where mean ages ranged between 67 and 73.8 years [9–11]. This relatively advanced age may be partly explained by diagnostic delay related to the nascent state of urology as a specialty in Burkina Faso. Historically, the management of urological pathologies, including prostate cancer, was largely handled by general surgeons in the absence of a structured urological referral network, which likely delayed patient identification and timely referral for early histopathological diagnosis.

Clinical and Paraclinical Data

Clinical symptoms in our series were dominated by urinary retention (59.8%), a proportion higher than those reported by Ludovic et al. in Ivory Coast (31%) and Maazou et al. in Niger (23.92%)[12, 13]. The paucisymptomatic nature of prostate cancer at a localized stage explains why urinary retention, when it occurs, represents a late complication of the disease rather than an early warning sign. This complication generally mandates referral to secondary or tertiary healthcare facilities capable of providing specialized management, which may account for the higher proportion of symptomatic patients with urinary retention in our cohort, recruited precisely from such institutions.

Digital rectal examination (DRE) raised suspicion of malignancy in 44.6% of cases in our series, confirming its central role in the diagnostic workup alongside total PSA (tPSA) testing [14]. Beyond guiding the decision to perform a biopsy, DRE provides an initial assessment of local disease extent while awaiting diagnostic imaging. The statistically significant association observed between DRE findings and Gleason score (p = 0.0002, Cramér's V = 0.30) aligns with underlying pathophysiology: high-grade, less-differentiated tumors are characterized by marked architectural disorganization and local invasion, which are more readily palpable on clinical examination.

Medical imaging data, available for only 16.1% of patients, must be evaluated within the context of the recent history of radiology in Burkina Faso. Prior to 2014, radiologists practiced exclusively in the country's two main cities, providing regional ultrasonography services through occasional monthly visits. The establishment of the post-graduate residency program in medical imaging in 2011 led to the training of approximately 100 radiologists between 2015 and 2023. Magnetic Resonance Imaging (MRI) was introduced only in 2018, initially restricted to private facilities; the public sector gained access to MRI in 2020 following the deployment of diagnostic equipment during the COVID-19 pandemic response. Thus, the low proportion of patients investigated by medical imaging in our study reflects an evolving, historically concentrated infrastructure rather than a lack of clinical ordering.

The mean total PSA level in our series (410.88 ng/mL) contrasts sharply with values reported in Western countries (4.0 to 9.9 ng/mL) [15]. Comparable, albeit higher, values were reported by Yevi et al. in Cotonou (830.2 ng/mL) [16]. The moderate positive correlation between total PSA and Gleason score (rho = 0.32) supports the hypothesis of diagnosis at an advanced stage, where PSA elevation reflects both total tumor volume and the degree of cellular dedifferentiation. This markedly elevated mean tPSA level can be largely attributed to the widespread reliance on traditional medicine prior to seeking conventional healthcare, a practice well documented in our setting. Furthermore, indwelling urinary catheterization (the first-line intervention for chronic urinary retention) abruptly halts sexual activity. This consequence, feared for its impact on marital life and self-image, prompts a subset of patients to defer conventional care and catheter placement in favor of traditional remedies perceived as less definitive, thereby delaying diagnosis and accounting for the extreme tPSA levels observed when diagnosis is finally established.

Morphological Data and Histoprognostic Factors

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Regarding specimen types, prostate core needle biopsy remained the most frequently received specimen (82.4%), a finding similar to those reported by Isidore et al. in Benin (80.7%) and Maazou et al. in Niger (83.78%) [11, 13]. This predominance is attributable to the central role of core needle biopsy as an indispensable prerequisite in the diagnostic pathway: it establishes the histological diagnosis and dictates all subsequent clinical management. In contrast, radical prostatectomy (performed with therapeutic rather than diagnostic intent) is undertaken only after diagnosis is established, accounting for its lower representation in our cohort.

Histologically, our series was overwhelmingly dominated by acinar adenocarcinoma (98.35% of cases), aligning with published literature where this subtype consistently predominates across both African and Western series [11, 17, 18]. Primary leiomyosarcomas accounted for 0.13% of cases, confirming their extreme rarity in adults, with a reported frequency in the literature hovering around 0.1% of all primary prostate malignancies [19]. The identification of secondary urothelial and squamous cell carcinomas with contiguous prostatic involvement, alongside rare primary entities such as intraductal and basal cell carcinomas, highlights the necessity of rigorous histological characterization for all prostatic lesions, as these uncommon variants carry distinct prognostic and therapeutic implications compared with conventional acinar adenocarcinoma.

- **Gleason Score and ISUP Grade Group**

The Gleason grading system, first introduced in 1966, remains one of the most reliable and universally accepted prognostic factors in prostate cancer [20]. For a given clinical or pathological stage, prognosis worsens as tumor differentiation decreases. Successive revisions by the International Society of Urological Pathology (ISUP) in 2005 and 2014 led to the adoption of the ISUP grade group classification (Grade Groups 1 to 5), driven by limitations in the interobserver reproducibility of the original system [20].

In our series, Gleason score 7 (comprising patterns 3+4 and 4+3) was the most frequent (46.5%), confirming the trend previously observed by Yaméogo et al. in Burkina Faso, albeit at a lower frequency in their study (30.4%) [18]. This score actually encompasses two distinct prognostic entities: 3+4 tumors, dominated by a well-differentiated component, and 4+3 tumors, dominated by a poorly differentiated component associated with a higher risk of disease progression, biochemical recurrence, and disease-specific mortality [21]. In practice, making this distinction presents a recurring challenge in our setting due to the limited volume of available biopsy tissue. Many prostate core biopsies in our context are digitally guided, yielding small-caliber or fragmented tissue samples. Frequently, the paraffin block becomes exhausted after the initial diagnostic sections are cut. This precludes cutting deeper tissue levels to accurately determine the respective proportion of both patterns, a technical limitation that hampers fine stratification into 3+4 versus 4+3 subtypes for a non-negligible proportion of Gleason score 7 cases in our series, despite its clinical utility in guiding therapeutic strategy.

The percentage of high-grade disease (pattern 4 or 5) is an established predictor of long-term outcomes. A Swedish cohort study reported a disease-specific mortality of 52% in the presence of high-grade patterns, compared to 8% in their absence [22]. In our series, reporting the proportion of high-grade lesions was documented in only 6.2% of pathology reports, compared to 30.6% in the United States [22]. This low reporting rate can be explained by the lack of standardized synoptic reporting templates and by non-systematic or suboptimal biopsy sampling of the prostate gland, which increases the risk of missing high-grade tumor foci.

- **Perineural Invasion**

Perineural invasion is associated with increased tumor aggressiveness and a higher risk of disease-specific mortality [23, 24]. In our series, perineural invasion status was addressed in 70.75% of pathology reports, and was confirmed as present in 35.75% of cases. This discrepancy reflects true under-reporting, driven by two main factors. First, the morphological distinction between true perineural invasion and simple contact artifact between malignant glands and nerve fibers can be subtle on certain histological sections. Second, a subset of pathology reports, drafted according to older practice habits, only documented perineural invasion when present, without explicitly commenting on its absence when negative. This practice, currently undergoing harmonization, highlights the need to emphasize mandatory binary reporting (present/absent) in continuing medical education programs for pathology teams. Furthermore, the widespread implementation of standardized synoptic reporting templates will ensure systematic documentation of perineural invasion status in all cases.

- **Lymphovascular Invasion**

Lymphovascular invasion, defined by the presence of tumor cells or tumor cell clusters within the lumen of blood or lymphatic vessels, represents a key step in metastatic dissemination and a well-established adverse prognostic indicator [25]. Available meta-analyses correlate its presence with more advanced pathological stage, high Gleason score, lymph node involvement, positive surgical margins, extraprostatic extension, and seminal vesicle invasion [26–28].

In our series, lymphovascular status was commented on in approximately 41% of pathology reports, but confirmed as present in only 7.5% of cases, a discrepancy even more pronounced than that observed for perineural invasion. This gap stems from similar factors: the diagnostic challenge of differentiating true tumor emboli from peritumoral retraction artifacts, and the persistent practice among certain pathologists of documenting this parameter only when positive. This under-reporting, much like that of perineural invasion, underscores the compelling need for systematic binary reporting of this prognostic factor [26].

- **High-Grade Prostatic Intraepithelial Neoplasia (HG-PIN)**

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High-grade prostatic intraepithelial neoplasia (HG-PIN) is currently recognized as the principal precursor lesion of prostatic adenocarcinoma, with a majority of affected patients developing invasive carcinoma within ten years [29, 30]. Current classification schemes simplify the historical three-tier grading system into two categories: low-grade and high-grade [29].

In our series, HG-PIN lesions were documented in 12.75% of pathology reports and confirmed present in 9.75% of cases. Although the discrepancy is less marked than for perineural or lymphovascular invasion, the underlying clinical rationale is even more questionable: a subset of pathologists considers HG-PIN (a pre-invasive lesion by definition) unworthy of reporting once invasive malignancy has been confirmed. However, this omission deprives clinicians of actionable diagnostic information, as HG-PIN signals potential tumor multifocality and warrants careful pathological inspection of the remaining tissue.

- **Surgical Margins and pTNM Stage in Radical Prostatectomy Specimens**

Among the 53 radical prostatectomy specimens in our series, surgical margin status, involvement of the bladder neck, apex, base, seminal vesicles, and regional lymph nodes were systematically evaluated. A positive surgical margin is associated with a 12% to 18% higher 5-year risk of biochemical recurrence compared to a negative margin. This risk of recurrence is further amplified by advanced pathological stage [31] and by the linear extent of margin involvement [32]. A meta-analysis evaluating six histopathological features confirmed their independent association with biochemical recurrence [33].

However, the accuracy of this pathological assessment directly depends on the quality of specimen orientation upon gross receipt. In our cohort, a subset of radical prostatectomy specimens was properly oriented and accompanied by usable surgical documentation; others bore orientation markers without descriptive notes, a situation resolved through direct telephone consultation with the operating surgeon. For the majority of cases, neither spatial orientation nor operative descriptions were provided; operating surgeons were subsequently invited to the gross pathology room, where specimen orientation was established collaboratively using the flat posterior surface of the prostate as the standard routine anatomical landmark. This systematic multidisciplinary collaboration is critical to the reliability of reported margin status and warrants formalization through a standardized specimen orientation requisition form.

The pTNM stage, established by histopathological examination of surgical specimens, provides superior prognostic value compared to preoperative clinical staging [34]. In our series, pTNM staging could only be determined when adequate surgical tissue was available: predominantly in radical prostatectomy specimens (84.4%), and far less frequently in transurethral resection of the prostate (TURP) chips (10.2%) or open adenomectomy specimens (16.0%), procedures intended for symptomatic relief rather than complete oncological resection.

- **Periprostatic Fat Infiltration**

Periprostatic adipose tissue infiltration, indicative of extraprostatic extension (EPE), was observed in 26.25% of cases. Concomitant with lymphovascular invasion, perineural invasion, and surgical margin involvement, extraprostatic extension defines pathological stage pT3, an independent adverse prognostic factor that warrants consideration of adjuvant therapy according to international clinical guidelines [28, 34].

CONCLUSION

This multicenter study (the largest national series reported to date) confirms a steady increase in diagnosed prostate cancer cases in Burkina Faso over the past decade. This upward trend reflects both the recent decentralization of anatomical pathology laboratories and urology-andrology departments nationwide, as well as a potential true increase in disease incidence. The patient cohort is characterized by diagnosis at an advanced stage, driven by the historic relative scarcity of specialized urological services and widespread reliance on traditional medicine, a practice partly influenced by fears regarding the impact of long-term indwelling catheterization on patient quality of life and marital relations.

While Gleason score and ISUP grade group remain the paramount prognostic indicators, their informative utility is hampered by real under-reporting of secondary parameters (including perineural invasion, lymphovascular invasion, and high-grade PIN) attributable in part to non-binary reporting habits among some pathologists. Likewise, the reliability of margin status and pTNM staging depends heavily on the accuracy of prostatectomy specimen orientation, where close interdisciplinary collaboration with operating surgeons currently compensates for the absence of a standardized orientation protocol. Finally, the significant associations identified between clinical parameters (DRE), serum biomarkers (tPSA), and Gleason score highlight the critical value of an integrated diagnostic approach. Standardizing histopathological reporting templates, establishing formal specimen orientation protocols, and expanding national access to medical imaging and urological care represent urgent priorities to improve prostate cancer management and patient outcomes in Burkina Faso.

DECLARATIONS

Ethics approval and consent to participate

Institutional authorization was obtained from the directors of the participating facilities and heads of the anatomic and cytological pathology laboratories.

Consent for publication

Not applicable (retrospective analysis of anonymized pathology records; no identifiable individual data are reported).

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

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Authors' contributions

- OS: Study conceptualization, overall coordination, data collection, morphological analysis, statistical analysis, writing original draft, and final approval of the version to be published.
- F.A.H.A.I: Morphological analysis, statistical analysis, and critical revision of the manuscript.
- FO and DDAT: Nationwide data collection across participating sites.
- IS: Writing original draft preparation (alongside OS).
- MBL: Data collection form design, coordination of data collection, and statistical analysis.
- AAZ, OAS, ALM, and OML: Comprehensive critical revision of the manuscript for important intellectual content and approval of the final submitted version.

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