Section: Pathology

Original Research Article

HISTOPATHOLOGICAL ANALYSIS OF PROSTATE CARCINOMA WITH EMPHASIS ON GLEASON'S MICROSCOPIC GRADING SYSTEM

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ABSTRACT

Background: Prostate carcinoma is one of the most common malignancies in older men. Histopathological examination remains the gold standard for diagnosis, while Gleason grading is an important tool for assessing tumor aggressiveness and prognosis. The aim and objective is to perform histopathological analysis of prostate adenocarcinoma and classify cases according to Gleason's microscopic grading system. **Materials and Methods:** This retrospective, hospital-based study was conducted in the Department of Pathology, Gandhi Medical College, Bhopal, from January 2023 to December 2024. A total of 20 histopathologic ally confirmed cases of prostate adenocarcinoma were included. Specimens included transurethral resection of prostate, prostate biopsy, and prostatectomy specimens. Cases were evaluated microscopically and categorized according to Gleason score and Gleason Grade Group. Data was analyzed using descriptive statistics. **Result:** The largest number of cases was observed in the 61–70-year age group, accounting for 10 cases (50.0%). Transurethral resection of the prostate specimens accounted for most samples, comprising 12 cases (60.0%). Histopathological findings included acinar arrangement, fused glands, cribriform pattern, and necrosis. Grade Group 1 was seen in 3 cases (15.0%), Grade Group 2 in 5 cases (25.0%), Grade Group 3 in 4 cases (20.0%), Grade Group 4 in 4 cases (20.0%), and Grade Group 5 in 4 cases (20.0%). Overall, 17 cases (85.0%) had a Gleason score ≥7. Prostate-specific antigen level was >10 ng/mL in 18 cases (90.0%). **Conclusion:** Prostate adenocarcinoma was more common in elderly patients, and most cases showed intermediate- to high-grade disease. Gleason grading, along with prostate-specific antigen level and histopathological assessment, plays an essential role in risk stratification, prognosis, and clinical management.

INTRODUCTION

Prostate carcinoma is one of the most common malignancies affecting men worldwide and remains an important cause of cancer-related morbidity and mortality. According to GLOBOCAN 2022 estimates, prostate cancer accounted for approximately 1.5 million new cases and 397,000 deaths globally, making it the second most frequently diagnosed cancer among men.[1] The incidence of prostate cancer increases markedly with advancing age, particularly after the fifth decade of life, and rising life expectancy has contributed to an increasing burden of disease in many countries, including India.[2] Although many prostate cancers follow an indolent course, a significant proportion may show aggressive biological behavior, local invasion, metastatic potential, and poor clinical outcome if diagnosed late.

Histopathological examination remains the gold standard for the diagnosis of prostate carcinoma. It not only confirms malignancy but also provides essential information regarding tumor architecture, differentiation, and biological aggressiveness. Among the different histological types, acinar adenocarcinoma is the predominant subtype. Microscopic evaluation commonly demonstrates variable glandular patterns, including well-formed acini, fused glands, poorly formed glands, cribriform architecture, and necrosis, which are important for tumor grading and prognostication.[3]

The Gleason grading system is the most widely accepted and clinically useful grading method for prostate adenocarcinoma. It is based on the architectural growth pattern of malignant prostatic glands rather than cytological atypia alone. The final Gleason score is obtained by adding the primary and secondary Gleason patterns, representing the

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predominant and second-most predominant tumor patterns. Higher Gleason scores are associated with increased tumor aggressiveness, greater risk of recurrence, metastasis, and poorer survival outcomes.[4] The International Society of Urological Pathology later introduced Grade Groups 1-5 to simplify prognostic interpretation, ranging from Gleason scores ≤6 to 9–10.[5]

Prostate-specific antigen is widely used as a screening and monitoring tool for prostate cancer; however, histopathological grading remains indispensable for definitive diagnosis and treatment planning. Correlation of prostate-specific antigen levels with Gleason score and histological grade helps in risk stratification and guides management decisions, including active surveillance, surgery, radiotherapy, androgen deprivation therapy, or multimodal treatment.[6] Therefore, histopathological assessment with Gleason grading continues to play a central role in evaluating prostate adenocarcinoma.

The present study was conducted to analyze the histopathological features of prostate adenocarcinoma and to classify the cases according to Gleason's microscopic grading system. This study also aims to describe the distribution of cases according to age, specimen type, prostate-specific antigen level, and Gleason grade group, thereby highlighting the importance of microscopic grading in assessing tumor aggressiveness and guiding clinical decision-making.

MATERIALS AND METHODS

This was a single-centre, hospital-based, retrospective histopathological study conducted in the Department of Pathology at Gandhi Medical College, Bhopal. The study was carried out on cases diagnosed as prostate adenocarcinoma on histopathological examination during the period from January 2023 to December 2024. A total of 20 histologically confirmed cases of prostate adenocarcinoma were included in the study.

The study population included patients whose prostate tissue specimens were received in the pathology department and were diagnosed as adenocarcinoma of the prostate. The specimens included transurethral resection of prostate specimens, prostate biopsy specimens, and prostatectomy specimens. Cases showing histological types other than adenocarcinoma, inadequate tissue material, poorly preserved tissue, or incomplete records were excluded from the study.

Relevant clinical and pathological details were collected from departmental records. These included the patient's age, type of specimen received, serum prostate-specific antigen level, histopathological diagnosis, Gleason score, and Gleason Grade Group. Serum prostate-specific antigen values were grouped into three categories: ≤4.0 ng/mL, 4.1–10.0 ng/mL, and >10.0 ng/m L.

All tissue specimens were fixed in 10% neutral buffered formalin. After adequate fixation, representative tissue sections were taken and processed using the routine paraffin-embedding technique. Sections were cut and stained with hematoxylin and eosin. The stained slides were examined under light microscopy to confirm the diagnosis and assess tumor morphology.

Microscopic examination was performed to identify the histopathological patterns of prostate adenocarcinoma, including acinar structures, fused glands, cribriform or sieve-like pattern, poorly formed glands, and luminal necrosis. Tumors were graded using Gleason's microscopic grading system. The most predominant architectural pattern was designated the primary Gleason pattern, and the second most predominant pattern was designated the secondary Gleason pattern. The final Gleason score was obtained by adding both patterns.

Cases were further classified into Gleason Grade Groups. Grade Group 1 included Gleason score 3+3=6, Grade Group 2 included Gleason score 3+4=7, Grade Group 3 included Gleason score 4+3=7, Grade Group 4 included Gleason score 8, and Grade Group 5 included Gleason scores 9–10. The cases were then analyzed according to age group, specimen type, serum prostate-specific antigen level, Gleason score, and Gleason Grade Group.

The collected data were entered into a spreadsheet and analyzed using descriptive statistics. Categorical variables were expressed as numbers and percentages. As the study was descriptive in nature and included a small sample size, no inferential statistical test was applied.

RESULTS

A total of 20 histopathologic ally confirmed cases of prostate adenocarcinoma were included in the study. The patients' ages ranged from 50 to 75 years. Most cases were observed in the 61–70 years age group, accounting for 10 cases (50%), followed by the 71–75 years age group with 6 cases (30%) and the 50–60 years age group with 4 cases (20%). This shows that prostate adenocarcinoma was most commonly seen in elderly males, especially after 60 years of age.

Regarding the type of specimen received, transurethral resection of the prostate specimens constituted the majority, with 12 cases (60%), followed by prostate biopsy specimens in 7 cases (35%) and prostatectomy specimens in 1 case (5%). On histopathological examination, the tumors showed features of prostatic adenocarcinoma, including acinar structures, fused glands, cribriform pattern, relatively uniform-sized glands, sieve-like arrangement, and luminal necrosis in some cases.

Based on the Gleason microscopic grading system, most tumors belonged to higher Gleason grade groups. Grade Group 1 / Gleason score 3+3=6 was seen in 3 cases (15%). Grade Group 2 / Gleason score 3+4=7 was seen in 5 cases (25%), while Grade Group 3 / Gleason score 4+3=7 was seen in 4 cases (20%). Grade Group 4/Gleason score 8 was seen in 4 cases (20%), including 3 cases with 3+5=8 and 1 case with

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4+4=8. Grade Group 5/Gleason score 9 was also seen in 4 cases (20%), including 2 cases with score 4+5=9 and 2 cases with score 5+4=9. Overall, 17 cases (85%) had a Gleason score ≥7, indicating predominance of intermediate- to high-grade tumors in the study population.

Serum prostate-specific antigen levels were also evaluated. None of the cases had a prostate-specific antigen level ≤4.0 ng/mL. Two cases (10%) had prostate-specific antigen values between 4.1 and 10.0 ng/mL, while 18 cases (90%) had prostate-specific antigen levels >10.0 ng/m L. The predominance of raised prostate-specific antigen levels was consistent with the higher Gleason scores observed in most cases.

Thus, the present study showed that prostate adenocarcinoma was most diagnosed in patients above 60 years of age, with transurethral resection of prostate being the most frequent specimen type. Most cases demonstrated a Gleason score ≥7 and prostate-specific antigen levels >10.0 ng/mL, suggesting that most patients presented with biologically aggressive and relatively advanced disease.

Table 1: Age-wise distribution of prostate adenocarcinoma cases

Age group (years)	Number of cases	Percentage (%)
50–60	4	20.0
61–70	10	50.0
71–75	6	30.0
Total	20	100.0

Table 2: Distribution according to the source of the histopathological specimen

Source of sample	Number of cases	Percentage (%)
Transurethral resection of prostate specimen	12	60.0
Prostate biopsy	7	35.0
Prostatectomy specimen	1	5.0
Total	20	100.0

Table 3: Distribution according to Gleason grade and Gleason score

Gleason grade group	Gleason score	Number of cases	Percentage (%)
Grade Group 1	3+3 = 6	3	15.0
Grade Group 2	3+4 = 7	5	25.0
Grade Group 3	4+3 = 7	4	20.0
Grade Group 4	3+5 = 8	3	15.0
Grade Group 4	4+4 = 8	1	5.0
Grade Group 5	4+5 = 9	2	10.0
Grade Group 5	5+4 = 9	2	10.0
Total		20	100.0

Table 4: Simplified distribution according to the Gleason risk category

Gleason score category	Number of cases	Percentage (%)
Gleason score ≤6	3	15.0
Gleason score 7	9	45.0
Gleason score 8–10	8	40.0
Total	20	100.0

Table 5: Distribution according to prostate-specific antigen level

Prostate-specific antigen level	Number of cases	Percentage (%)
≤4.0 ng/mL	0	0.0
4.1–10.0 ng/mL	2	10.0
>10.0 ng/mL	18	90.0
Total	20	100.0

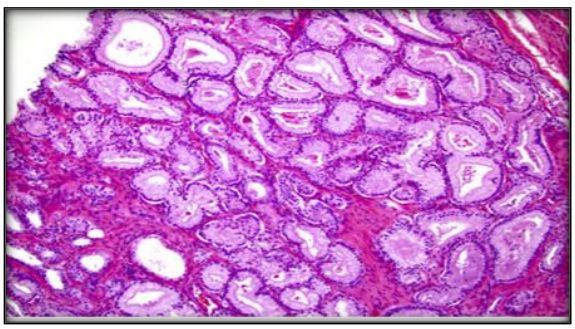

Figure 1: shows a prostatic adenocarcinoma composed of relatively uniform-sized malignant glands arranged with variable spacing. The glands show architectural irregularity and are lined by atypical epithelial cells. This pattern represents gland-forming adenocarcinoma and supports the histopathological diagnosis of prostate carcinoma.

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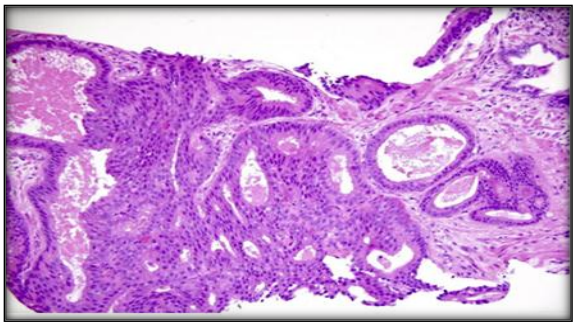

Figure 2: demonstrates malignant prostatic glands arranged in fused and cribriform or sieve-like patterns. The tumor glands are closely packed with loss of normal glandular separation. This architectural pattern is important for Gleason's microscopic grading and suggests a higher-grade component of prostatic adenocarcinoma.

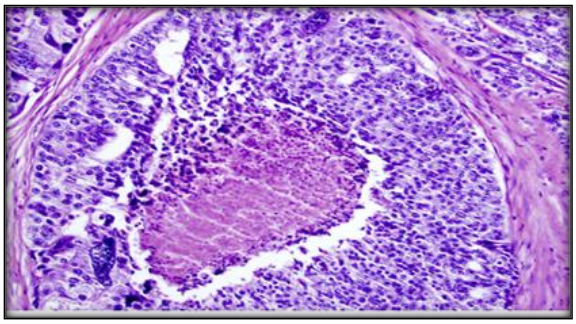

Figure 3: shows malignant glandular spaces containing luminal necrosis. The presence of necrotic material within the tumor gland space indicates aggressive tumor morphology. This finding is associated with high-grade prostatic adenocarcinoma and helps in assigning a higher Gleason grade.

DISCUSSION

The present retrospective histopathological study evaluated 20 cases of prostate adenocarcinoma with emphasis on Gleason's microscopic grading system. In this study, the highest number of cases was observed in the 61–70-year age group, followed by the 71–75-year age group. This finding supports the well-established observation that prostate carcinoma is predominantly a disease of older men, and its incidence increases with advancing age.[1] Globally, prostate cancer remains one of the most frequently diagnosed malignancies among males, and ageing of the population is expected further to increase its clinical burden in the coming years.[3]

In the present study, transurethral resection of the prostate specimens accounted for the largest proportion of samples, followed by prostate biopsy and prostatectomy specimens. Histopathological examination remains the gold standard for diagnosis of prostate adenocarcinoma, as it allows confirmation of malignancy along with evaluation of tumor architecture, differentiation, and grade.[4] The 2022 World Health Organization classification emphasizes the continued importance of accurate histological typing and grading of prostate tumors, especially because morphology remains central to diagnosis and clinical decision-making.[5]

Most cases in the present study showed features of conventional acinar adenocarcinoma, including acinar structures, fused glands, cribriform pattern, and luminal necrosis. These architectural patterns are important because the Gleason grading system is primarily based on glandular architecture rather than cytological atypia alone.[6]. ell-formed, separate glands are generally associated with lower Gleason patterns, whereas fused glands, poorly formed glands, cribriform architecture, and comedo necrosis are associated with higher-grade disease.[8,9] The presence of cribriform patterns and coagulation necrosis in some cases in this study, therefore, indicates an aggressive histological morphology.

Most cases in this study had a Gleason score ≥7, accounting for 85% of all cases. Only 15% of cases belonged to a Gleason score ≤6. This predominance of intermediate- to high-grade tumors suggests that many patients are presented at a relatively advanced histological stage. Similar observations have been reported in studies from developing settings, where delayed presentation, low screening awareness, and limited access to early diagnostic facilities may contribute to a higher proportion of advanced-grade tumors at diagnosis.[10,11] The high proportion of Gleason scores 7 and above is clinically important because higher Gleason scores are strongly associated with increased risks of biochemical recurrence, metastasis, and disease-specific mortality.[12]

The Gleason grading system has undergone several modifications since its original description. The International Society of Urological Pathology introduced revised criteria for Gleason grading. It later proposed the Grade Group system from 1 to 5 to improve prognostic clarity and communication with clinicians and patients.[13] In the present study, Grade Group 2 and Grade Group 3 together constituted a substantial proportion of cases, while Grade Groups 4 and 5 were also common. This finding indicates that many cases had clinically significant diseases requiring active treatment rather than conservative management. The Grade Group system is particularly useful because it separates Gleason score 3+4=7 from 4+3=7, as the latter has a worse prognosis due to predominance of pattern 4 tumor.[16]

Prostate-specific antigen was markedly elevated in most cases in the present study. Ninety percent of patients had prostate-specific antigen levels >10 ng/mL. In contrast, only 10% had levels between 4.1 and 10.0 ng/m L. None of the cases had prostate-specific antigen ≤4.0 ng/m L. Raised prostate-specific antigen is widely used as an important clinical marker for prostate cancer detection, risk assessment, and follow-up; however, it is not specific for malignancy and must be interpreted along with clinical and histopathological findings.[17] In this study, the predominance of high prostate-specific antigen values corresponded with the predominance of Gleason score ≥7 tumors, suggesting that higher

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prostate-specific antigen levels were associated with more aggressive histological disease.

The findings of this study highlight the practical importance of Gleason grading in routine pathology reporting. While prostate-specific antigen and clinical examination may raise suspicion of malignancy, definitive diagnosis and risk stratification depend on microscopic evaluation. Accurate assignment of Gleason score and Grade Group helps clinicians decide between active surveillance, radical prostatectomy, radiotherapy, androgen deprivation therapy, or multimodal treatment.[11,12] Cases with a Gleason score ≤6 and low prostate-specific antigen may be suitable for active surveillance in selected patients, whereas cases with a Gleason score ≥7 usually require more aggressive clinical management.[18]

The present study has certain limitations. The sample size was small, and the study was conducted at a single center, which may limit generalizability. As this was a retrospective histopathological study, clinical staging, radiological findings, treatment details, and follow-up outcomes were not available for correlation. Despite these limitations, the study provides useful insight into the histopathological pattern and Gleason grade distribution of prostate adenocarcinoma in the studied population.

Overall, the present study demonstrates that prostate adenocarcinoma was most seen in elderly males and that most cases showed intermediate- to high-grade disease. The predominance of Gleason score ≥7 and prostate-specific antigen >10 ng/mL suggests delayed diagnosis and aggressive tumor biology in a large proportion of patients. Therefore, early screening, timely biopsy, and accurate histopathological grading are essential for appropriate risk stratification and management of prostate carcinoma.

CONCLUSION

The present study highlights the importance of histopathological examination and Gleason microscopic grading in evaluating prostate adenocarcinoma. In this study, prostate carcinoma was predominantly observed in elderly males, with most cases occurring after 60 years of age. Most specimens were obtained through transurethral resection of the prostate, followed by prostate biopsy. Histopathological examination showed characteristic features of prostatic adenocarcinoma, including acinar structures, fused glands, cribriform pattern, and luminal do necrosis. Most cases had a Gleason score ≥7, indicating predominance of intermediate- to high-grade tumors and suggesting aggressive tumor biology. Prostate-specific antigen levels were also elevated in most patients, with 90% showing values >10 ng/mL. These findings emphasize that many patients present at an advanced histological grade. Early prostate-specific antigen screening, timely biopsy, and accurate Gleason grading are essential for risk stratification, treatment planning, and improved patient outcomes.

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