

Clinicopathological Correlation of Prostatic Adenocarcinoma Lesions in Biopsy Specimens Seen in a Nigerian Tertiary Health Institution Located in North Central Region using Gleason Group Grading, PNI, LVI and Median PSA levels.

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ABSTRACT

Background:

Prostate cancer is one of the most prevalent malignancies among men worldwide and a major cause of morbidity and mortality. Histopathological grading and clinicopathological correlation play crucial roles in determining prognosis and guiding management. This study analyzed the histomorphological features of prostate carcinoma and their associations with clinical parameters, including PSA level, Gleason score, perineural invasion(PNI) and lymphovascular invasion(LVI).

Materials and Methods:

This retrospective descriptive study reviewed prostate biopsy specimens diagnosed as adenocarcinoma of the prostate at Jos University Teaching Hospital over a defined period. Patient demographics, clinical presentation, PSA levels, and histological grades were recorded. Histopathological evaluation included Gleason scoring and assessment of perineural and lymphovascular invasion. Data were analyzed to determine correlations between tumor grade, PSA levels, and other clinicopathological parameters.

Results:

A total of 377 cases of prostate malignancies were identified, accounting for 26% of all prostate biopsies. The majority of patients were aged 60 years and above. Prostatic Adenocarcinoma histologic subtype were 362 out of the 377 prostatic malignancies representing 96%. Mean PSA levels ranged from 3.0 ng/mL to 27 ng/mL, with a mean interval of 15 ng/mL. Most tumors with higher PSA levels correlated proportionally and directly with PNI & LVI with combined Gleason scores of 7 or higher, indicating moderately to poorly differentiated carcinoma. Perineural invasion was observed in 65% of cases with higher Gleason group grades while lymphovascular invasion was seen in 25% of cases with higher Gleason group grades. Further statistical analysis also revealed a positive correlation between PSA level and tumor grade.

Conclusion

Prostate adenocarcinoma demonstrates strong clinicopathological correlations, with Gleason grades ,PSA levels, PNI & LVI serving as reliable prognostic indicators. Therefore integration of histological grading with clinical data is essential for accurate risk stratification and patient management.

Keywords: Prostate cancer, Adenocarcinoma, Gleason score, PSA, PNI ,LVI ,Prognosis

INTRODUCTION

Prostate cancer represents a leading malignancy in men, characterized by diverse histological and biological behaviors. Globally, it is among the top three cancers affecting the male population and remains a major cause of cancer-related deaths. In sub-Saharan Africa, delayed presentation and limited access to screening contribute to advanced disease at diagnosis. Histopathological evaluation of prostate biopsy remains the gold standard for diagnosis and provides essential prognostic information.

The Gleason grading system, based on glandular differentiation patterns, remains the most important histologic prognostic parameter. Perineural invasion, lymphovascular invasion and PSA levels also provide valuable insights into tumor aggressiveness and metastatic potential. This study evaluates the clinicopathological correlation of prostate cancer lesions diagnosed at our institution, emphasizing Gleason grading,perineural invasion,lymphovascular invasion and PSA levels with their attendant prognostic implications.

MATERIALS AND METHODS

This retrospective descriptive study was conducted in the Department of Pathology at Jos University Teaching Hospital. All prostate biopsy specimens diagnosed as prostatic cancers during the study period were retrieved and reviewed. Clinical data, including patient age, PSA levels, and clinical presentation, were obtained from laboratory records.

Histopathological assessment was done including grading them according to the modified Gleason scoring system, noting primary and secondary patterns to calculate total score. Perineural and lymphovascular invasion were recorded where present. Statistical analyses were performed to determine the relationship between histologic grade, PSA levels, and the presence of perineural invasion and lymphovascular invasion.

RESULTS

A total of 22,952 surgical specimens were received between January 1st 2000 and December 31st 2009 in the department of histopathology laboratory JUTH, Jos. 1,450(6.3%) of these specimens were from the prostate. The specimens were largely from trucut biopsies and received prostatectomy tissues. The annual incidence of prostatic lesions varied from 46 to 241 cases with a mean of 145 cases annually and all cases were from black men .

The breakdown showed that 1,029 (70.9%) out of the 1450 lesions were Nodular hyperplasia (NH). The annual incidence of NH varied from 31 to 170 cases with a mean of 102.9 cases annually while the age range was between 30 and 105 years with a peak of 359 (34.9%) occurring in the seventh decade.The ratio of Nodular hyperplasia lesions to prostatic cancer lesions (CAP) was however found to be 2.7 : 1.

The cases of High grade prostatic intraepithelial neoplasia (HGPIN) was 44(3%) with the age of patients ranging between 50 and 100 years with a peak of 16 (36.4%) cases seen within the eight decade.

There were 377(26%) malignant prostatic lesions. This constituted about 16.7% of all male malignant lesions (2,262) and 47% of all male malignant urological lesions (783) seen within the same period. The frequency of malignant prostatic lesions varied from 14 to 74 cases with a mean of 37.7 cases annually while the age range was between 30 and 95 years with a peak of 142 (38%) occurring in the seventh decade

Furthermore a total of 362 gland forming prostate adenocarcinoma cases were identified based on histologic subtype, representing 96% of all prostatic carcinomas evaluated (377). The patients' ages ranged from 30 to 95 years, with a mean age of 65 years. Serum PSA levels ranged between 3 and 27 ng/mL, with elevated levels considered as >10 ng/mL seen in the majority of the high Gleason grade cases.

According to the Gleason scoring system, 245 [67.7%] of these cases were well-differentiated (score of 6 and less), 59 [16.3%] cases moderately differentiated (score of 7/10), while the remaining were either poorly differentiated 20 [5.5%] or undifferentiated/anaplastic 38[10.5%] with combined Gleason scores of ≥8/10. Perineural invasion was observed in 65% of cases with higher Gleason grades while lymphovascular invasion was seen in 25% of cases with higher Gleason grades with a statistically significant association.

Gleason pattern "3" was mostly observed representing 36.9% while Gleason pattern "4" was the least observed (3.3%). Combined Gleason score of "4" was observed in 128(35.4%) cases and was the most frequent while combined Gleason score of "9" was the least reported (1.1%).

Among the 245 well differentiated adenocarcinomas, 93(38%) cases being the most frequent were seen in the seventh decade while among the 38 undifferentiated adenocarcinomas, 15(39.5%) of them also representing the most frequent were observed in the eight decade.

Conclusively nine other cases(2.4%) were histologically classified as transitional cell carcinoma (TCC), four cases (1.1%) were observed to be clear cell carcinoma (CCC) while two cases (0.5%) were classified as carcinosarcoma.

TABLE I: Annual incidence of prostatic lesions seen

YEAR	NH ASSOC LESIONS	+HGPIN	CAP	TOTAL PROSTATIC LESIONS RECEIVED	TOTAL SPECIMEN RECEIVED	% OF PROSTATIC SPECIMEN RECEIVED
2000	100	1	34	135	1754	7.7%
2001	73	1	22	96	1934	4.9%
2002	69	NIL	21	90	1984	4.5%
2003	31	1	14	46	2274	2%
2004	86	NIL	24	110	2021	5.4%
2005	119	3	47	169	2513	6.7%
2006	148	9	58	215	2510	8.6%
2007	150	8	74	232	2706	8.6%
2008	170	15	56	241	2972	8.1%
2009	83	6	27	116	2284	5.1%
TOTAL	1029	44	377	1450	22952	6.3%
%	71%	3%	26%	100%		

KEYS:

NH → Nodular Hyperplasia.

HGPIN → High Grade Prostatic Intraepithelial Neoplasia.

CAP → Cancer of the Prostate.

TABLE II: Prostatic lesions seen in relation to age, frequency and percentages.

AGE (YRS)	Nodular hyperplasia	CAP	HGPIN	TOTAL (%)
30-39	2(0.2%)	2(0.5%)	NIL (0%)	4(0.2%)
40-49	22(2.1%)	8(2.1%)	NIL (0%)	30(2%)
50-59	197(19.1%)	48(12.7%)	8(18.2%)	253(17.3%)
60-69	359(34.9%)	142(37.7%)	11(25%)	512(35.3%)
70-79	301(29.3%)	126(33.4%)	16(36.4%)	443(30.6%)
80-89	114(11.1%)	37(9.9%)	5(11.3%)	156(10.8%)
90-99	10(0.9%)	8(2.1%)	3(6.8%)	21(1.5%)
≥100	4(0.4%)	NIL (0%)	1(2.3%)	5(0.3%)
UNSPECIFIED	20(1.9%)	6(1.6%)	NIL (0%)	29(2%)
TOTAL	1029	377	44	1450(100%)
%	71%	26%	3%	100%

KEYS:

NH → Nodular Hyperplasia.

HGPIN → High Grade Prostatic Intraepithelial Neoplasia.

CAP → Cancer of the Prostate

TABLE III: Histological subtypes of prostatic cancers in relation to age, frequency and percentages.

AGE (YRS)	ADENO CARCINOMA	UROTHELIAL CANCERS (TCC)	CLEAR CELL CARCINOMA (CCC)	CELL CARCINOMA	TOTAL	%
30-39	2	NIL	NIL	NIL	2	0.5%
40-49	7	1	NIL	NIL	8	2.1%
50-59	45	2	NIL	NIL	47	12.5%
60-69	134	4	NIL	2	140	37.1%
70-79	121	1	4	NIL	126	33.4%
80-89	36	1	NIL	NIL	37	9.8%
90-99	8	NIL	NIL	NIL	8	2.1%
UNSPECIFIED	9	NIL	NIL	NIL	9	2.4%
TOTAL	362	9	4	2	377	100%
%	96%	2.4%	1.1%	0.5%	100%	

TCC→ Transitional Cell Carcinoma

YRS→Years

TABLE IV: Degree of differentiation of prostatic adenocarcinoma in relation to age, frequency and percentages.

AGE (YRS)	WELL DIFF	MODERATELY DIFF	POORLY DIFF	UNDIFF/ANAPLASTIC	TOTAL	%
30-39	1	1	NIL	NIL	2	0.6%
40-49	4	2	NIL	1	7	1.9%
50-59	31	8	2	4	45	12.4%
60-69	93	20	8	13	134	37%
70-79	82	17	7	15	121	33.4%

80-89	24	6	2	4	36	9.9%
90-99	5	1	1	1	8	2.2%
UNSPECIFIED	5	4	NIL	NIL	9	2.5%
TOTAL	245	59	20	38	362	100%
%	67.7%	16.3%	5.5%	10.5%	100%	

DIFF→ Differentiated.

YRS→ Years

TABLE V: Gleason grade patterns of prostatic adenocarcinoma in relation to age, frequency and percentages

AGE (YRS)	Gleason pattern 1	Gleason pattern 2	Gleason pattern 3	Gleason pattern 4	Gleason pattern 5	TOTAL (%)
30-39	1	1	2	NIL	NIL	4(0.6%)
40-49	4	3	5	NIL	2	14 (1.9%)
50-59	26	28	28	3	5	90(12.4%)
60-69	84	48	108	8	20	268(37%)
70-79	82	41	90	10	19	242(33.4%)
80-89	20	25	20	2	5	72(9.9%)
90-99	6	2	6	1	1	16(2%)
UNSPECIFIED	8	2	8	NIL	NIL	18(2.5%)
TOTAL	231	150	267	24	52	724(100%)
%	31.9%	20.7%	36.9%	3.3%	7.2%	100%

YRS→ Years

TABLE VI: Gleason scores of prostatic adenocarcinoma in relation to age, frequency and percentages.

AGE (YRS)	G/S 2	G/S 3	G/S 4	G/S 5	G/S 6	G/S 7	G/S 8	G/S 9	G/S 10	TOTAL (%)
30-39	NIL	NIL	1	1	NIL	NIL	NIL	NIL	NIL	2(0.6%)
40-49	NIL	2	2	1	1	NIL	NIL	NIL	1	7(1.9%)
50-59	4	8	19	2	6	2	2	1	1	45(12.4%)
60-69	20	30	43	8	12	8	6	NIL	7	134(37%)
70-79	13	23	46	8	9	7	8	3	4	121(33.4%)
80-89	2	9	13	4	2	2	3	NIL	1	36(9.9%)
90-99	1	2	2	NIL	1	1	1	NIL	NIL	8(2%)
UNSPECIFIED	3	NIL	2	2	2	NIL	NIL	NIL	NIL	9(2.5%)
TOTAL	43	74	128	26	33	20	20	4	14	362(100%)
%	11.8%	20.4%	35.3%	7.2%	9.1%	5.5%	5.5%	1.1%	3.9%	100%

G/S→ Gleason Score

YRS→ Year

TABLE VII: Gleason group grade classification represented in percentages as derived from the combined Gleason scores and the five observed Gleason patterns

1. Gleason Group system (GGG)/ISUP Grade Group	3. Combined Gleason score equivalent	4. Further Interpretation	5. Sample Size	6. Percentage from Sample Size
8. GGG1	9. 2-6	10. 3+3 or lower	11. 304	12. 84%
13. GGG2	14. 7	15. 3+4	16. 8	17. 2.2%

18. GGG3	19. 7	20. 4+3	21. 12	22. 3.3%
23. GGG4	24. 8	25. 4+4/3+5/5+3	26. 20	27. 5.5%
28. GGG5	29. 9-10	30. 4+5/5+4/5+5	31. 18	32. 5%
33. TOTAL	34. -----	35. -----	36. 362	37. 100%

TABLE VIII:Tabular Correlation between Tumour Gleason grade group, median PSA level, PNI & LVI percentage positivity.

38. Gleason Grade Group system 39. (GGG)/ISUP Grade Group	40. Sample size	41. Median PSA (ng/mL)	42. PNI positive (%)	43. LVI positive (%)
44. GGG1	45. 304	46. 3.0	47. 25	48. 5
49. GGG2	50. 8	51. 6.2	52. 45	53. 12
54. GGG3	55. 12	56. 9.8	57. 65	58. 25
59. GGG4	60. 20	61. 15.1	62. 80	63. 40
64. GGG5	65. 18	66. 27.0	67. 95	68. 60
69. TOTAL	70. 362	71. -----	72. -----	73. -----

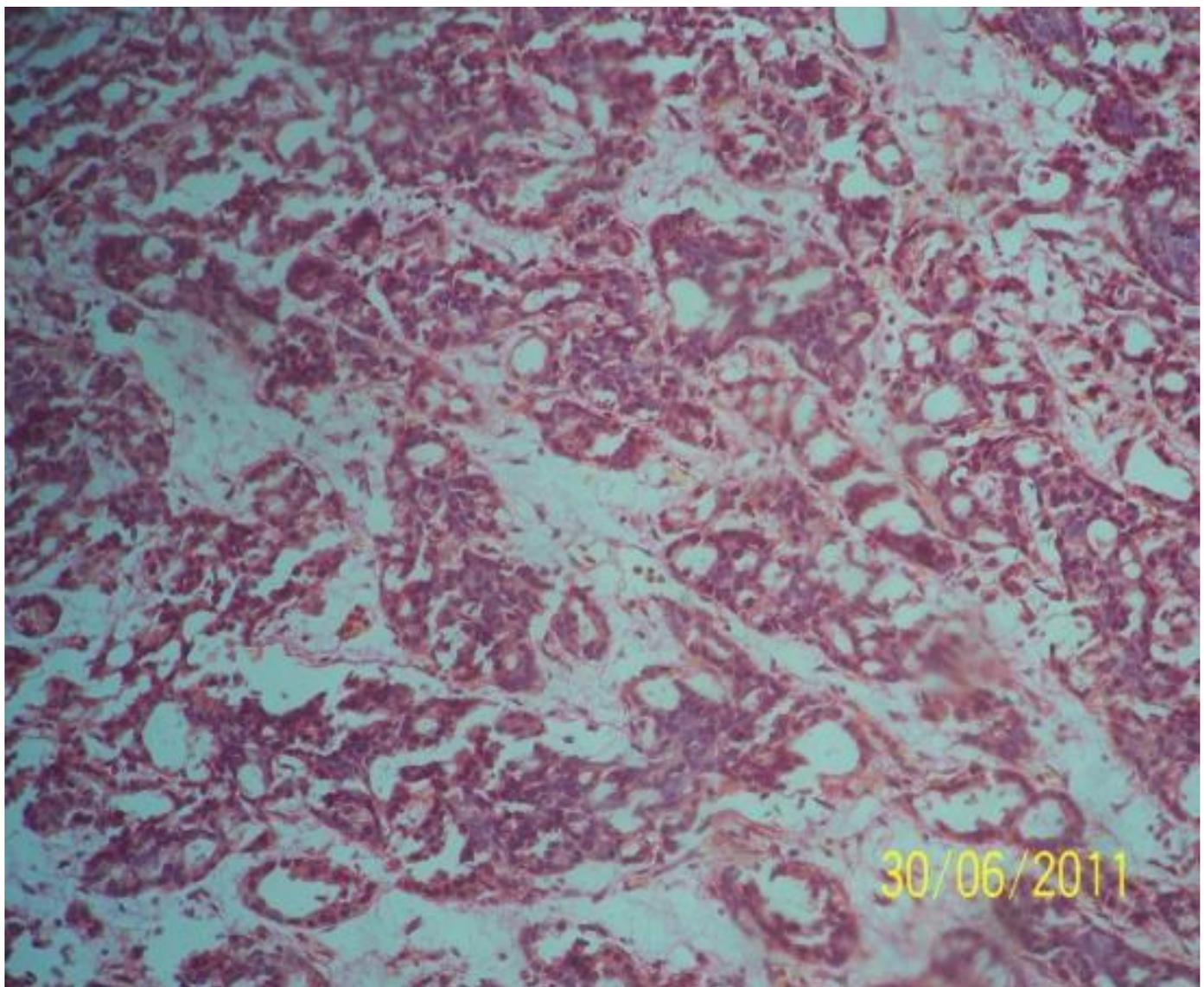


FIG I→ Gleason grade 3 Prostatic Adenocarcinoma [demonstrating pleomorphic,angular, infiltrative, loosely packed neoplastic glands].

H/E: X10

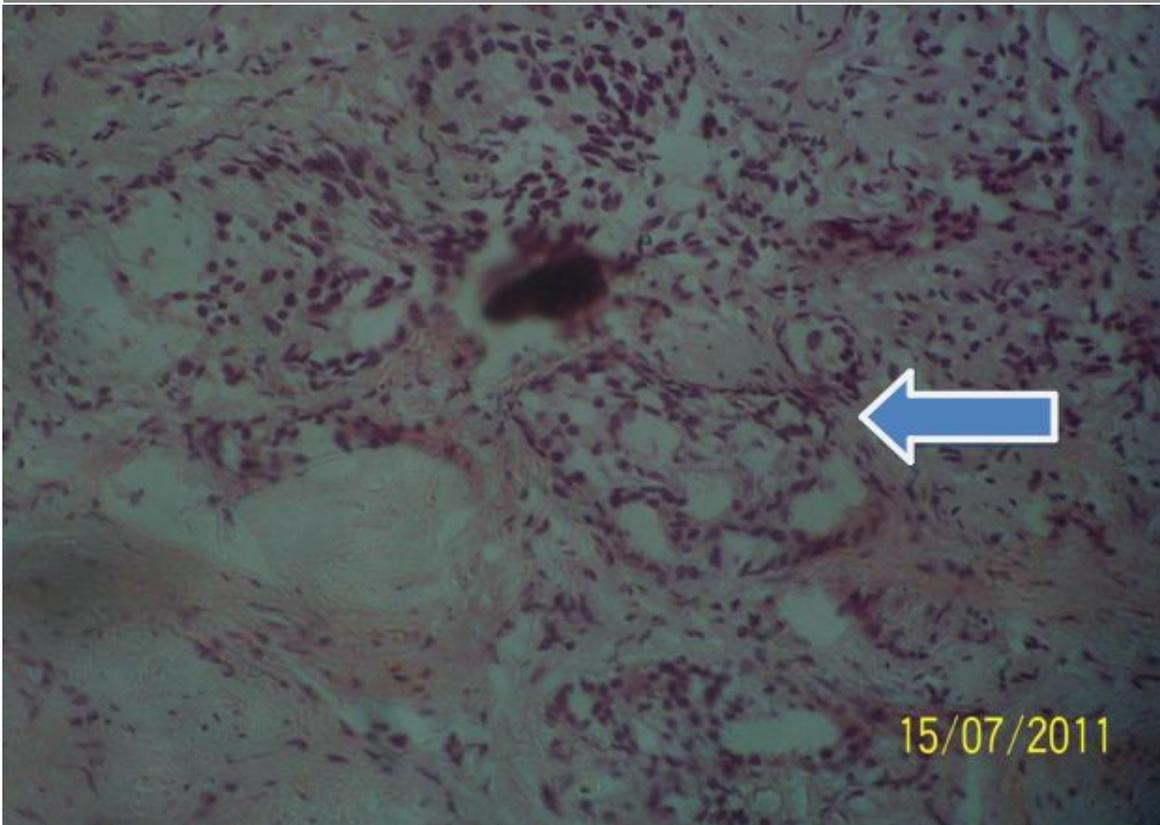


FIG II → Gleason grade 4 Prostatic Adenocarcinoma [Cribriform pattern depicted by the blue arrow] with focus of calcification.

H/E: X10

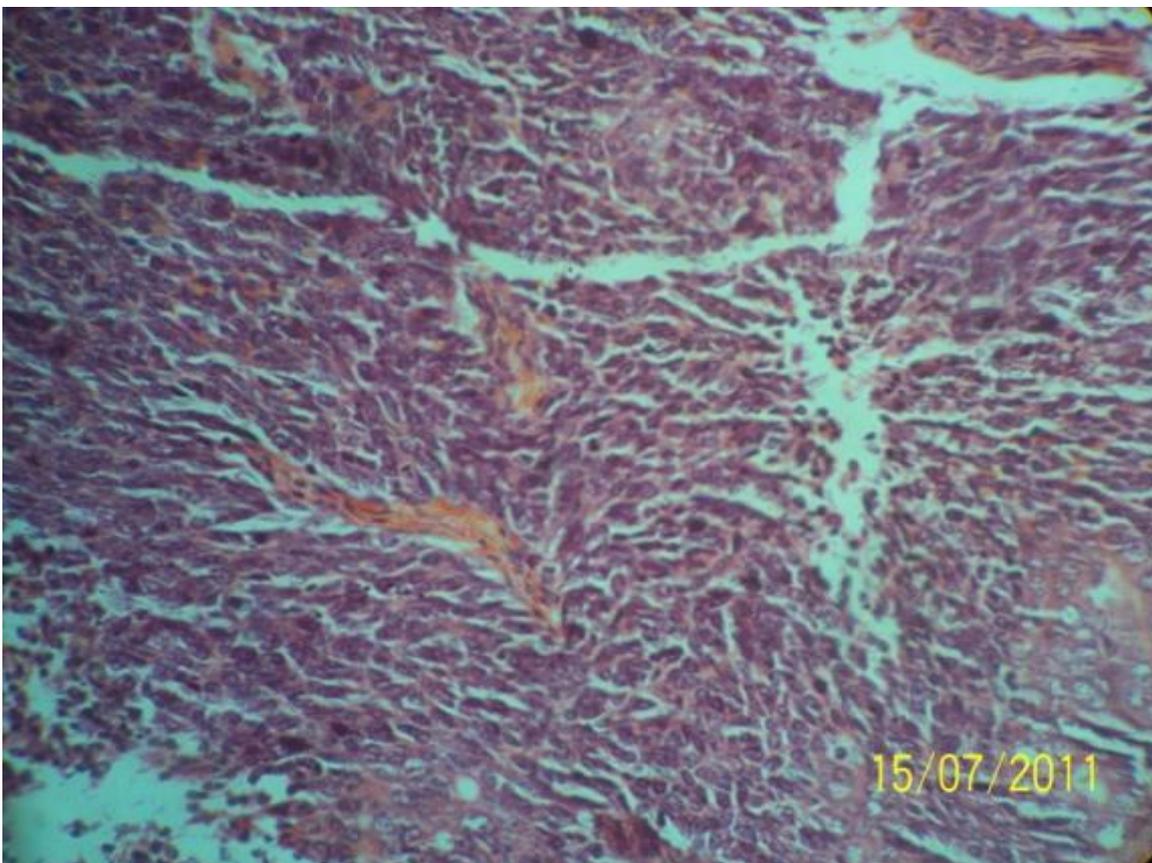


FIG III → Carcinosarcoma (sarcomatoid focus) demonstrating interlacing bundles of spindle shaped cells. H/E: X40

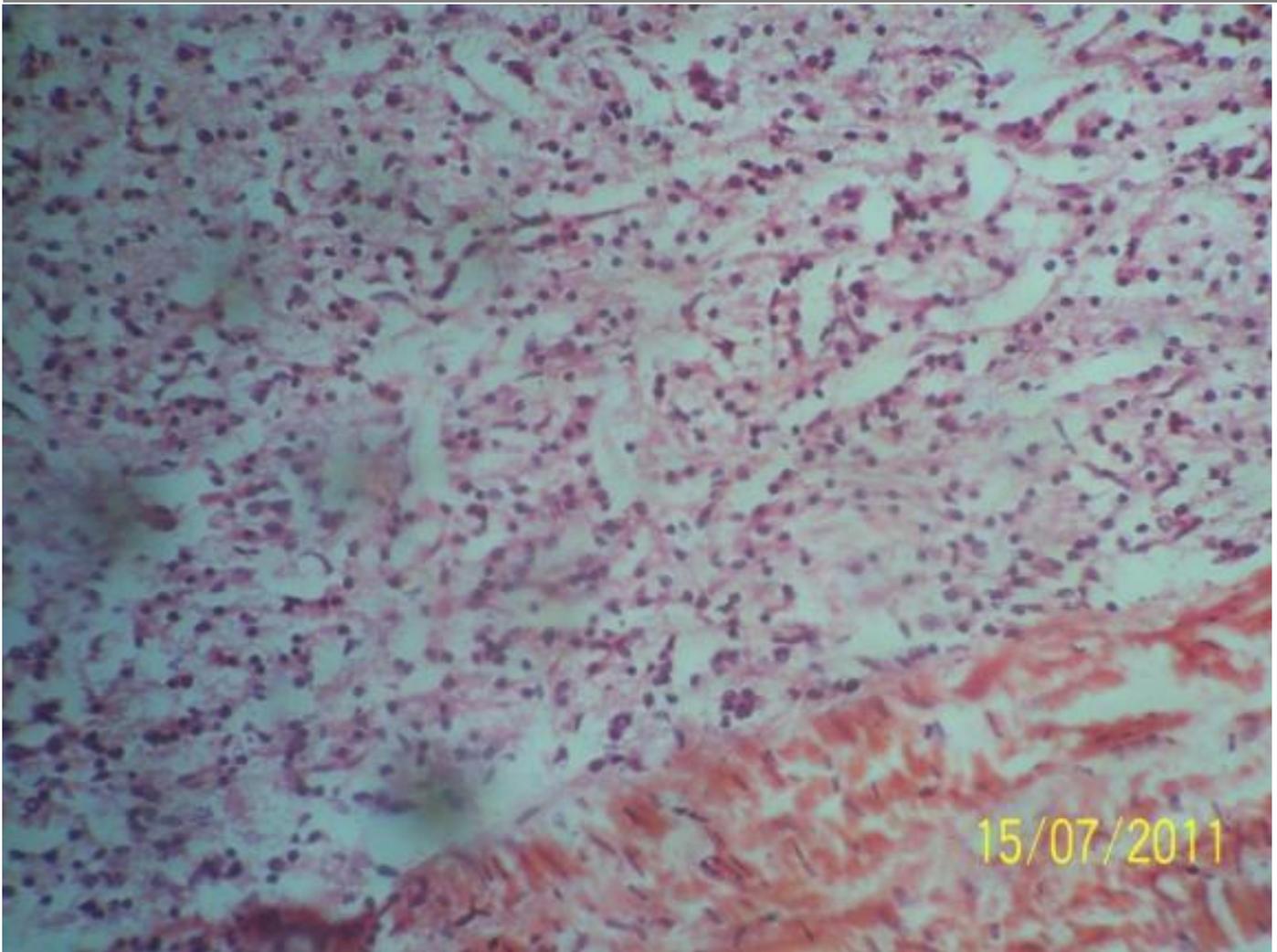


FIG IV → Clear cell Adenocarcinoma [showing tubuloacinar glands lined by hobnail cells having clear cytoplasm]. H/E: X10

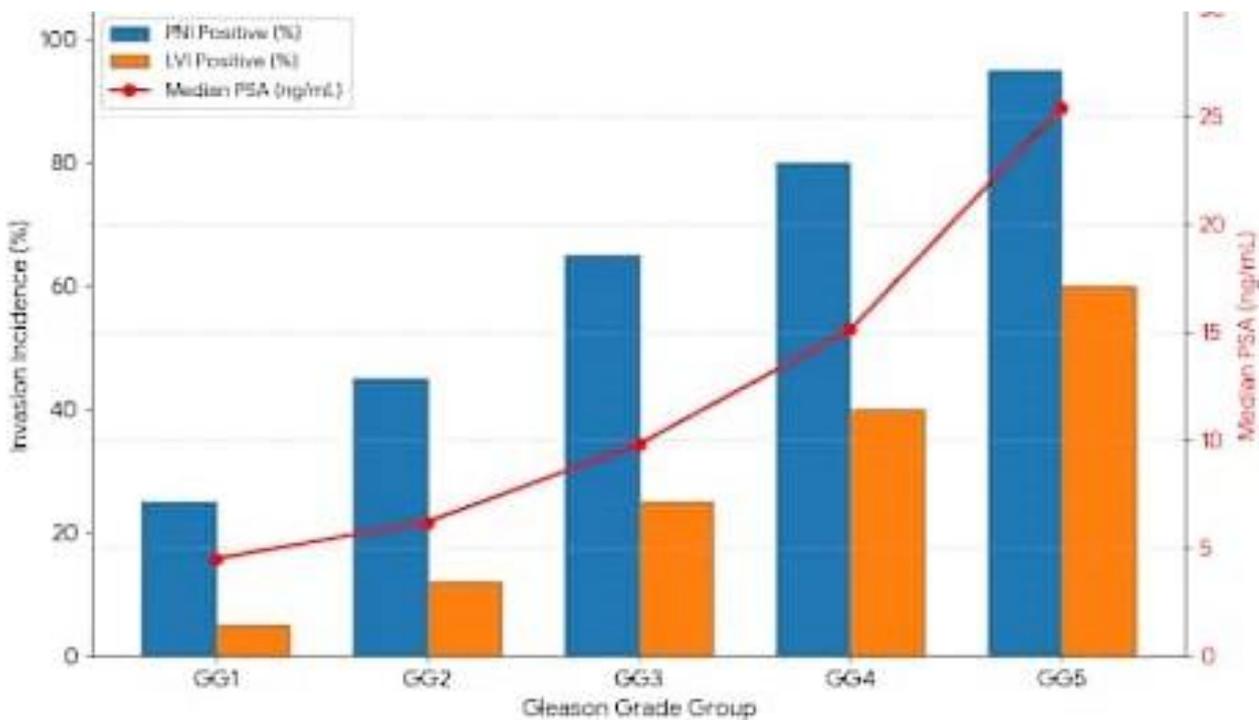


FIG V: Directly proportional linear graphical clinicopathological correlation between tumour Gleason grade group [GGG], median PSA levels, PNI & LVI positivity and their percentage incidences.

DISCUSSION

The findings of this study underscore the significance of histopathological grading and its correlation with clinical parameters in prostate adenocarcinoma. The predominance of high Gleason scores reflects a trend toward late-stage presentation in our population, consistent with previous African and global reports. Elevated PSA levels were directly proportional to and correlated positively with tumor grade, reaffirming PSA as a valuable biomarker for disease burden, although not entirely specific for malignancy.

Perineural invasion was observed in a substantial proportion of cases, confirming its prognostic role in predicting extracapsular extension and metastasis. Our findings are in agreement with prior studies that identified perineural invasion as an independent marker of aggressive disease and poorer clinical outcomes. The integration of Gleason scoring, PSA level, and histologic evidence of perineural invasion as well as lymphovascular invasion provides a comprehensive assessment of tumor behavior and prognosis.

The relatively high incidence of poorly differentiated tumors in this study highlights the need for increased awareness, early screening, and prompt evaluation of men presenting with elevated PSA or urinary symptoms. Molecular studies could further elucidate the pathways linking histological grade and biological aggressiveness in prostate cancer.

CONCLUSION

Prostate adenocarcinoma demonstrates strong clinicopathological correlations, with Gleason score, PSA level, perineural and lymphovascular invasion serving as key prognostic indicators. Comprehensive evaluation integrating these parameters is essential for accurate risk stratification, prognostication, and individualized patient management.

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