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Real-World Treatment Patterns, Progression-Free Survival, and Overall Survival Outcomes in Prostate Cancer Patients at a South Indian Tertiary Cancer Centre: A Retrospective Study

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ABSTRACT

Background: Prostate cancer outcomes in India are influenced by stage at presentation, treatment access, and real-world patterns of care. Evidence linking treatment patterns with progression-free survival and overall survival from Indian tertiary cancer centres remains limited.

Methods: This retrospective hospital-based cohort study was conducted in the Department of Medical Oncology, Kidwai Memorial Institute of Oncology, Karnataka, India. Patients with histologically confirmed carcinoma prostate registered and treated between 1st August 2018 and 31st July 2023 were included. Baseline clinical characteristics, stage, metastatic status, treatment received, progression status, and survival outcomes were recorded. Overall survival and progression-free survival were estimated using the Kaplan-Meier method, and survival curves were compared using the log-rank test. Cox proportional hazards regression was used to assess factors associated with mortality and progression.

Results: A total of 95 patients were included. The mean age was 67.93 ± 8.6 years, and the median baseline PSA was 85 ng/mL. Metastatic disease was present in 60 patients (63.16%) at presentation. Among metastatic patients, hormone-sensitive prostate cancer was more common than castration-resistant disease. Androgen deprivation-based therapy formed the main treatment approach, with bilateral orchidectomy alone being the most common first-line palliative treatment. The estimated overall survival was 97.65% at 12 months and 85.11% at 36 months. Overall survival did not differ significantly across stage groups. In contrast, progression-free survival differed significantly by stage, with metastatic patients showing poorer outcomes. Median PFS was 32 months overall and 24 months among metastatic patients.

Conclusion: Metastatic presentation was common and was associated with inferior progression-free survival. The study highlights the need for earlier diagnosis, systematic risk stratification, and wider access to intensified systemic therapy in real-world Indian oncology practice.

Keywords: *Prostate cancer; treatment patterns; progression-free survival; overall survival; androgen deprivation therapy; India.*

INTRODUCTION

Prostate cancer is a major and growing malignancy among men worldwide, with its burden shaped by population ageing, diagnostic access, and stage at detection. In the 2022 GLOBOCAN estimates, prostate cancer accounted for a substantial share of the global cancer burden and remained among the most frequently diagnosed cancers in men [1]. The concern is not limited to current incidence alone; the Lancet Commission on prostate cancer projected that annual new cases may rise from approximately 1.4 million in 2020 to 2.9 million by 2040, with a large part of this increase expected in low-and middle-income countries where late diagnosis and unequal access to treatment remain important challenges [2]. These trends make prostate cancer not only an oncological problem but also a health-system preparedness issue, particularly in settings where advanced disease continues to dominate clinical presentation.

In India, prostate cancer has historically been reported at lower incidence rates than in many Western countries, but recent registry-based evidence suggests a gradual epidemiological shift. National Cancer Registry Programme estimates showed a continuing rise in overall cancer incidence in India, with prostate cancer emerging as an important malignancy among older men [3]. A recent NCRP analysis of prostate cancer from 2012–2019 reported marked heterogeneity across Indian registries, higher burden in several urban population-based registries, and a sharp rise in incidence after 50 years of age, particularly after 64 years [4]. The same analysis also highlighted that a considerable proportion of Indian patients are diagnosed with distant metastatic disease, underscoring the need to examine real-world treatment and survival outcomes in Indian clinical settings.

Regional evidence from South India further indicates that prostate cancer is becoming increasingly relevant in tertiary-care practice. A North Karnataka tertiary-centre study described prostate cancer as an emerging clinical problem and emphasized the importance of institution-level data to understand local disease characteristics [5]. Population-based registry review data from Kerala also showed increasing cancer incidence across major registries, reflecting the demographic and health-transition patterns seen in several southern states [6]. However, South Indian data linking treatment patterns with progression-free survival and overall survival remain limited, particularly from real-world hospital cohorts.

Although registry studies describe incidence, stage, and broad treatment modalities, they often do not capture granular treatment pathways, progression events, and survival experience within tertiary oncology practice. Centre-level outcome studies are therefore necessary to understand how stage, metastatic status, treatment selection, and disease progression interact in routine care. The present study aimed to evaluate real-world treatment patterns, progression-free survival, overall survival, and prognostic factors among prostate cancer patients treated at a South Indian tertiary cancer centre.

MATERIALS AND METHODS

Study design and setting

This retrospective hospital-based cohort study was conducted in the Department of Medical Oncology, Kidwai Memorial Institute of Oncology, Karnataka, India. Patients with carcinoma prostate registered and treated between 1st August 2018 and 31st July 2023 were included. The study evaluated real-world treatment patterns, progression-free survival, overall survival, and factors associated with disease progression and mortality.

Ethical approval

The study was conducted after obtaining approval from the Institutional Ethics Committee. As this was a retrospective review of hospital records, no direct patient contact or intervention was involved. Patient confidentiality was maintained throughout the study, and all data were anonymised before analysis.

Study population

All patients with histologically confirmed carcinoma prostate who were managed in the Department of Medical Oncology during the study period were screened for eligibility. A total of **95 patients** fulfilled the study criteria and were included in the final analysis.

Inclusion and exclusion criteria

Patients were included if they had histologically confirmed carcinoma prostate, were registered and treated at the study centre during the study period, and had adequate baseline clinical, pathological, treatment, and follow-up information.

Patients were excluded if records were incomplete, histological confirmation was unavailable, follow-up details were insufficient for survival or progression assessment, or if they had completed primary treatment elsewhere and attended the centre only for follow-up or opinion.

Data collection and variables

Data were collected retrospectively from hospital case records, pathology reports, radiology records, treatment charts, discharge summaries, and follow-up files using a structured data extraction format. The recorded variables included age at

diagnosis, addiction history, comorbidities, family history, presenting symptoms, ECOG performance status, baseline prostate-specific antigen level, histopathological diagnosis, Gleason score, stage at presentation, metastatic status, site of metastasis, treatment received, progression status, date of last follow-up, and survival status.

Gleason score was grouped as 6, 7, and 8-10. Baseline PSA was recorded at diagnosis or first presentation to the oncology department and summarized using appropriate descriptive statistics because of its skewed distribution.

Staging and treatment classification

Stage at presentation was classified as localized, locally advanced, or metastatic disease based on clinical records, histopathology, radiological findings, and treating oncologist documentation. Sites of metastasis were recorded as bone, regional lymph nodes, non-regional lymph nodes, lung, liver, or other documented sites. In metastatic cases, disease status was classified as hormone-sensitive prostate cancer or castration-resistant prostate cancer according to available clinical documentation.

Treatment was categorized according to disease stage and intent. For localized disease, radical prostatectomy status was recorded. For locally advanced disease, treatment was classified as androgen deprivation therapy, radiation therapy, or combined androgen deprivation therapy with radiation therapy. Androgen deprivation therapy included bilateral orchidectomy and medical castration using luteinizing hormone-releasing hormone agonists such as leuprolide, goserelin, or triptorelin. For metastatic disease, first-line palliative treatment was recorded, including orchidectomy-based and leuprolide-based regimens with or without bicalutamide, docetaxel, abiraterone, or enzalutamide.

Outcome measures

The primary outcomes were overall survival and progression-free survival**.** Overall survival was defined as the time from diagnosis or first registration at the study centre to death from any cause. Patients who were alive at last follow-up were censored on the date of last contact.

Progression-free survival was defined as the time from diagnosis or initiation of treatment to first documented disease progression or death, whichever occurred earlier. Progression was determined from clinical, biochemical, radiological, or treatment-record documentation. Patients without documented progression or death were censored at last follow-up.

Statistical analysis

Categorical variables were summarized as frequencies and percentages. Continuous variables were summarized as mean with standard deviation or median with interquartile range, depending on distribution. Chi-square test or Fisher's exact test was used for categorical comparisons. One-way ANOVA or Kruskal-Wallis test was used for comparison of continuous variables across stage groups.

Overall survival and progression-free survival were estimated using the Kaplan-Meier method and compared using the log-rank test. Cox proportional hazards regression was performed to identify factors associated with mortality and progression. Hazard ratios with 95% confidence intervals were reported. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 95 patients with histologically confirmed carcinoma prostate were included in the analysis. The mean age at diagnosis was 67.93 ± 8.60 years, and the median age was 68 years. Baseline prostate-specific antigen showed a markedly skewed distribution, with a median value of 85 ng/mL. Most patients had good functional status at presentation, with ECOG performance status 1 documented in 71 patients. High-grade disease was common, with Gleason score 8-10 reported in 56 of 93 patients with available Gleason score data. At presentation, 17 patients had localized disease, 18 had locally advanced disease, and 60 had metastatic disease. Among metastatic patients, hormone-sensitive prostate cancer was more frequent than castration-resistant prostate cancer. Bone was the most common metastatic site. (Table 1)

Treatment patterns varied according to disease extent. Among metastatic patients, androgen deprivation-based therapy formed the mainstay of treatment. Bilateral orchidectomy alone was the most common first-line palliative approach, followed by bilateral orchidectomy with bicalutamide and bilateral orchidectomy with docetaxel. Novel hormonal agent-based regimens were used in a smaller proportion of patients. (Table 2)

At the end of follow-up, 85 patients were alive and 10 had died. The estimated overall survival was 97.65% at 12 months and 85.11% at 36 months. Although metastatic patients showed numerically lower survival than localized and locally advanced groups, the difference in overall survival across stage groups was not statistically significant by log-rank test. (Table 3; Figure 1)

Progression-free survival showed a clearer stage-wise difference. Overall, 40 progression or death events were observed. The estimated progression-free survival was 84.49% at 12 months and 44.88% at 36 months, with a median PFS of 32 months. Median PFS was not reached in localized and locally advanced disease groups, whereas metastatic patients had a

median PFS of 24 months. The difference in PFS across stage groups was statistically significant by log-rank test. (Table 4; Figure 2)

Among metastatic patients, progression-free survival differed across first-line palliative treatment categories. However, several treatment subgroups had small numbers of patients; therefore, this comparison should be considered exploratory and hypothesis-generating rather than definitive. **(**Table 5; Figure 3)

In exploratory Cox regression analysis, metastatic stage and bone metastasis were associated with poorer progression-free survival in univariate analysis. These associations were not retained in the adjusted model, likely reflecting collinearity between metastatic stage and metastatic site variables, as well as limited event numbers. Mortality-related Cox regression findings should be interpreted cautiously because only 10 deaths occurred in the cohort. (Table 6)

Table 1. Baseline clinical and disease characteristics of the study cohort

Characteristic	Category / summary	n (%) or value
Age (years)	Mean ± SD	67.93 ± 8.60
Age (years)	Median (IQR); range	68 (62-73.5); 45-91
Baseline PSA (ng/mL)	Mean ± SD	460.96 ± 976.09
Baseline PSA (ng/mL)	Median (IQR); range	85 (25.5-304); 0.05-5000
ECOG performance status	0	3 (3.16)
ECOG performance status	1	71 (74.74)
ECOG performance status	2	17 (17.89)
ECOG performance status	3	4 (4.21)
Gleason score*	6	5 (5.38)
Gleason score*	7	32 (34.41)
Gleason score*	8-10	56 (60.22)
Stage at presentation	Localized	17 (17.89)
Stage at presentation	Locally advanced	18 (18.95)
Stage at presentation	Metastatic	60 (63.16)
Metastatic disease status†	Hormone-sensitive prostate cancer	51 (85.00)
Metastatic disease status†	Castration-resistant prostate cancer	9 (15.00)
Major metastatic sites‡	Bone	59 (98.3)
Major metastatic sites‡	Regional lymph nodes	49 (81.7)
Major metastatic sites‡	Non-regional lymph nodes	8 (13.3)
Major metastatic sites‡	Lung	6 (10.0)
Major metastatic sites‡	Liver	3 (5.0)

**Gleason score available for 93 patients. †Percentages calculated among metastatic patients (n=60). ‡Metastatic sites are multiple-response variable.*

Table 2. Treatment distribution according to disease category

Disease category	Treatment category	n (%)
Localized disease (n=17)	Radical prostatectomy	8 (47.06)
Localized disease (n=17)	No radical prostatectomy / other documented management	9 (52.94)
Locally advanced treatment group (n=18)	ADT alone	5 (27.78)
Locally advanced treatment group (n=18)	ADT + radiation therapy	13 (72.22)
Metastatic disease (n=60)	Bilateral orchidectomy alone	20 (33.33)
Metastatic disease (n=60)	Bilateral orchidectomy + bicalutamide	16 (26.67)
Metastatic disease (n=60)	Bilateral orchidectomy + docetaxel	13 (21.67)
Metastatic disease (n=60)	ADT + novel hormonal agent (abiraterone/enzalutamide-based)	7 (11.67)
Metastatic disease (n=60)	Leuprolide alone	4 (6.67)

ADT: androgen deprivation therapy.

Table 3. Overall survival estimates in the study cohort

Variable	Overall cohort	Localized	Locally advanced	Metastatic
Total N	95	17	18	60
Deaths, n	10	2	0	8
Censored, n (%)	85 (89.47)	15 (88.24)	18 (100.00)	52 (86.67)
12-month OS	97.65%	100%	100%	96.15%
36-month OS	85.11%	91.67%	100%	78.42%

Variable	Overall cohort	Localized	Locally advanced	Metastatic
End-study OS	75.59%	80.21%	100%	65.35%
Mean OS, months (95% CI)	50.14 (46.71-53.57)	-	-	-
Log-rank p-value for stage comparison	-	-	0.260	-

OS: overall survival; CI: confidence interval.

Table 4. Progression-free survival estimates in the study cohort

Variable	Overall cohort	Localized	Locally advanced	Metastatic
Total N	95	17	18	60
Progression/death events, n	40	4	5	31
Censored, n (%)	55 (57.89)	13 (76.47)	13 (72.22)	29 (48.33)
12-month PFS	84.49%	94.12%	88.24%	81.01%
36-month PFS	44.88%	76.05%	59.59%	31.95%
End-study PFS	29.09%	65.19%	59.59%	8.39%
Mean PFS, months (95% CI)	34.05 (29.43-38.66)	45.58 (36.82-54.34)	40.29 (28.76-51.83)	29.13 (23.84-34.42)
Median PFS, months (95% CI)	32 (20.48-43.52)	Not reached	Not reached	24 (13.13-34.87)
Log-rank p-value for stage comparison	-	-	0.012	-

PFS: progression-free survival; CI: confidence interval.

Table 5. Progression-free survival according to first-line palliative treatment among metastatic patients

First-line palliative treatment among metastatic patients	Total N	Events, n	Censored, n (%)	12-month PFS	36-month PFS	End-study PFS
Bilateral orchidectomy	20	8	12 (60.00)	84.38%	16.44%	16.44%
Bilateral orchidectomy + abiraterone	4	2	2 (50.00)	75.00%	75.00%	0%
Bilateral orchidectomy + bicalutamide	16	7	9 (56.25)	86.54%	55.63%	18.54%
Bilateral orchidectomy + docetaxel	13	9	4 (30.77)	76.92%	30.77%	15.38%
Bilateral orchidectomy + enzalutamide	1	0	1 (100.00)	100%	100%	100%
Leuprolide	4	2	2 (50.00)	75.00%	0%	0%
Leuprolide + abiraterone	2	2	0 (0.00)	50.00%	0%	0%
Log-rank p-value	-	-	-	-	0.038	-

PFS: progression-free survival.

Table 6. Cox proportional hazards regression for mortality and progression

Outcome	Variable	Hazard Ratio	95% CI	p-value
Mortality	Smoking	17.752	1.820–173.113	0.013
Mortality	Back pain	4.242	1.200–14.989	0.025
Progression	Metastatic stage	3.987	1.378–11.534	0.011
Progression	Bone metastasis	2.676	1.262–5.675	0.010
Progression, adjusted model	Metastatic stage	3.817	0.579–25.174	0.164
Progression, adjusted model	Bone metastasis	1.046	0.212–5.151	0.956

CI: confidence interval. Progression model adjustment included stage and bone metastasis as reported in the source analysis.

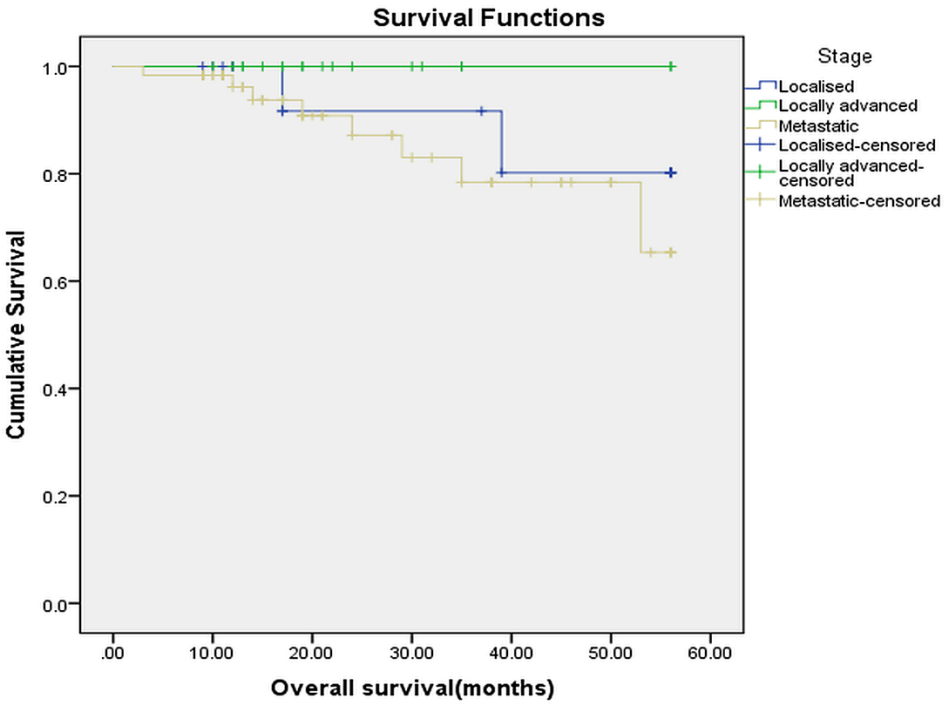

Figure 1. Kaplan-Meier curve comparing overall survival according to stage at presentation among prostate cancer patients.

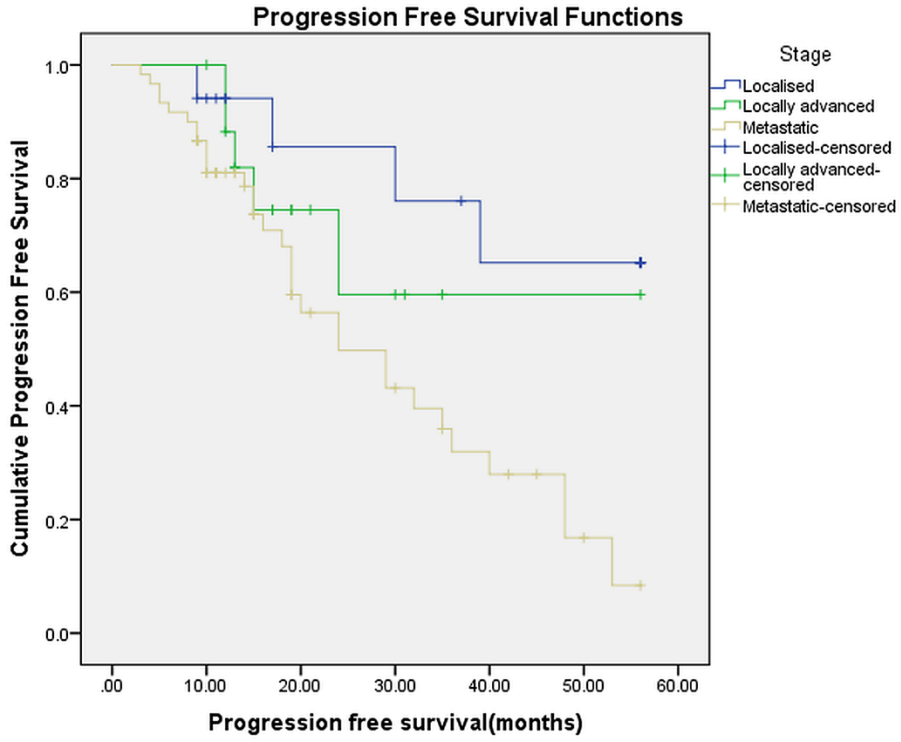

Figure 2. Kaplan-Meier curve comparing progression-free survival according to stage at presentation among prostate cancer patients.

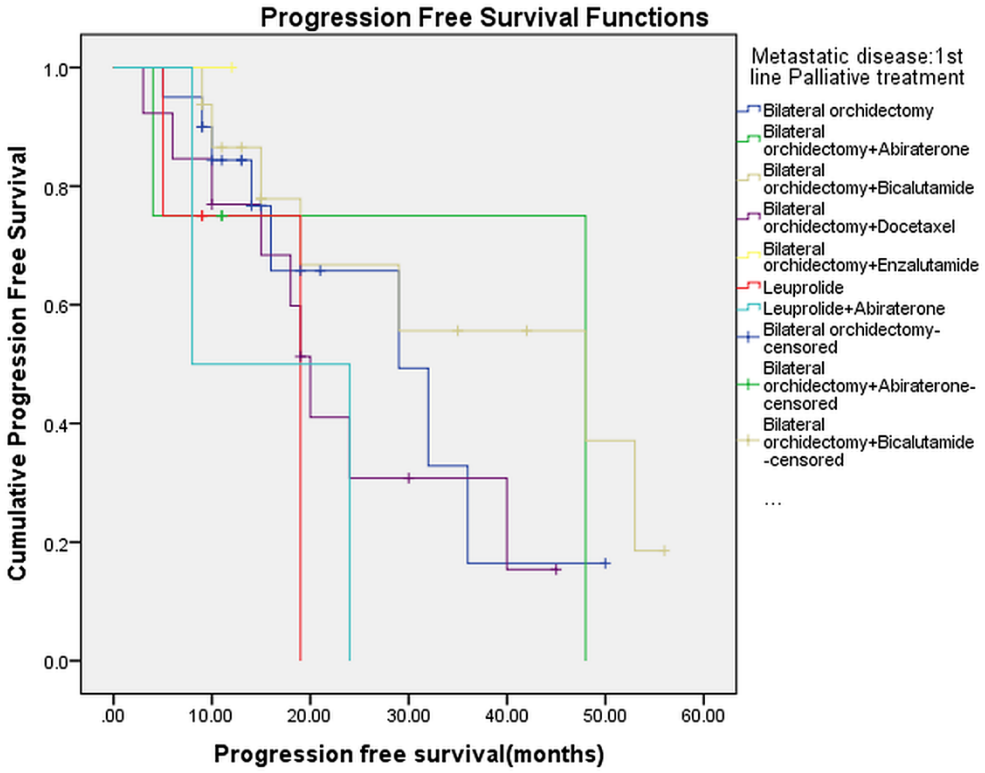

Figure 3. Kaplan-Meier curve comparing progression-free survival according to first-line palliative treatment among metastatic prostate cancer patients.

DISCUSSION:

In this retrospective cohort of prostate cancer patients treated at a South Indian tertiary cancer centre, the mean age at diagnosis was 67.93 years, with most patients presenting in the seventh decade of life. This age profile is consistent with Indian tertiary-care reports, including the recent Tata Memorial Hospital survival study, where the mean age was 66 years, and with earlier Indian series showing prostate cancer as predominantly a disease of older men [7]. The high proportion of metastatic disease at presentation in the present study is also in accordance with Indian hospital-based data. In our cohort, 63.16% of patients had metastatic disease at diagnosis, comparable to the Tata Memorial study, where 58.4% had metastatic cancer, and lower than the North-East Indian series, where 77.3% presented with stage IV disease [7,8]. However, this contrasts with some urban tertiary-care reports from India, where a larger proportion of patients had localized disease, possibly reflecting greater PSA testing, earlier referral, and better access to imaging [9].

The predominance of high-grade disease and elevated PSA values in the present cohort further supports the pattern of late clinical presentation. The median PSA was 85 ng/mL, and Gleason score 8–10 was seen in 60.22% of patients. These findings are broadly similar to Indian reports where symptomatic presentation, high PSA, and poorly differentiated tumours remain common [7-9]. This differs from many Western settings, where wider PSA testing and structured diagnostic pathways have shifted a larger proportion of cases toward earlier-stage detection.

Treatment patterns in this study reflect real-world practice in an Indian public-sector tertiary oncology setting. Androgen deprivation therapy formed the backbone of treatment, with bilateral orchidectomy alone being the most common first-line palliative approach among metastatic patients. This is consistent with Indian and other resource-constrained settings, where surgical castration may be preferred because of cost, adherence, and access considerations [8]. However, contemporary global evidence supports treatment intensification in metastatic hormone-sensitive prostate cancer, with trials showing survival benefit from adding docetaxel or abiraterone to ADT [10-12]. In our cohort, docetaxel and novel hormonal agents were used in a smaller proportion of patients, reflecting the gap between trial-based standards and real-world treatment accessibility.

Overall survival was relatively preserved, with 12-month and 36-month OS of 97.65% and 85.11%, respectively. Although metastatic patients had numerically poorer OS, the stage-wise difference was not statistically significant, likely due to the small number of death events. In contrast, progression-free survival showed a significant stage-wise gradient, with metastatic disease having inferior PFS. This aligns with published Indian survival data showing disease extent as a major determinant of outcome [7]. The exploratory finding that first-line palliative treatment categories differed in PFS should be interpreted cautiously because several subgroups were small. Similarly, the Cox regression findings for mortality, particularly smoking and back pain, require careful interpretation due to sparse events. Overall, the study

reinforces that late-stage presentation remains a major driver of progression outcomes and highlights the need for earlier diagnosis, better risk stratification, and wider access to intensified systemic therapy in Indian tertiary-care settings.

CONCLUSION

In this retrospective tertiary-centre cohort of prostate cancer patients, progression-free survival showed a significant stage-wise difference, with metastatic disease associated with poorer PFS. Overall survival remained relatively preserved and did not differ significantly by stage, likely because of the small number of death events. Real-world treatment patterns showed continued reliance on androgen deprivation-based approaches, including bilateral orchidectomy, with selected use of docetaxel and novel hormonal agents.

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