Original Research Article

Determinants of survival and prognostic factors in patients with prostate cancer: a retrospective analysis (2009-2018)

ABSTRACT

Objective: To evaluate prognostic factors and survival determinants of patients with prostate cancer (PC) admitted to an oncology hospital.

Method: Retrospective cohort study on 3,450 medical records of patients undergoing cancer treatment from 2009 to 2018, with follow-up until 2020, at the Center for High Complexity in Oncology (CACON), Muriaé, Minas Gerais, Brazil. Overall survival was estimated using the Kaplan-Meier method. For paired comparisons, the log-rank test was used. For multivariate analysis, the Cox Proportional Hazards method.

Results: From 2009 to 2018, 3,450 patients with PC were identified; the predominant profile of multiracial men (45.9%), with an average age of 72 years, no family history of cancer (39.6%), clinical stage II (57.70%), low Gleason score <=6 (52 .7%) and PSA level <10 ng/ml (40.9%). The probability of survival was estimated at 36, 48, and 60 months. Longer survival was found in men aged <60 - 36 (95% CI: 97); 48 (95% CI: 96); 60 (95% CI: 96). Gleason score: <=6 - 36 (95% CI: 98); 48 (95% CI: 97); 60 (95% CI: 96). Stage I: 36 (95% CI: 99); 48 (95% CI: 99); 60 (95% CI: 99). Initial treatment – Radiotherapy: 36 (95% CI: 97); 48 (95% CI: 96); 60 (95% CI: 96). PSA: <10 (ng/ml) 36 (95% CI: 99); 48 (95% CI: 98); 60 (95% CI: 98).

Conclusion: The individuals evaluated in this study had survival rates at 60 months higher than those observed in the national and world average for PC and prognostic factors, age >70 years, stage III and IV, elevated Gleason, and PSA >10 ng/ml. The results allow the use of new early diagnosis and treatment measures in the public network – Unified Health System (SUS), as well as proposing new control strategies and health promotion actions, aiming to reduce the morbidity and mortality of patients with PC.

Keywords: Prostate cancer. Survival. Epidemiology.

1. INTRODUCTION

PC is the most common type of cancer in the male population in 112 countries, representing 14.1% of the incidence and 6.8% of cancer mortality worldwide, which corresponds to 1.4 million new cases and 375 thousand deaths in 2020. In the same year, the age-standardized incidence rate of this neoplasm was 65.5, while mortality was 13.6 per 100,000 individuals in South America [1]. And, in addition to being one of the most prevalent neoplasms in Brazil, it is one of the most studied in the world due to its high rates of morbidity and mortality [1].

According to the José Alencar Gomes da Silva National Cancer Institute (INCA), PC represents 29.2% of all male cancers in Brazil, corresponding to 65,840 new cases in each year of the 2020-2022 triennium [2], demonstrating a large demand in public health [3,4]. Among the types of cancer that affect the male population, skin cancer (non-melanoma) has the highest incidence, followed by PC. The prostate tumor can remain asymptomatic for many years due to its slow growth. However, in some cases, it can develop quickly and affect other organs, contributing to the patient's death [5].

According to data from GLOBOCAN [6], the number of PC cases in the world was 1,414,259, with a global crude mortality rate of 9.5% corresponding to 375,304/100,000 inhabitants. It is most commonly diagnosed in approximately 87 countries, including the Americas and most of Europe, Australia and Africa, according to the latest global estimate [7], namely in Asia, with an estimated PC incidence of 26.2% (371,225), Europe 33.5% (473,344), Oceania 1.6% (22,421), Africa 6.6% (93,173), North America 16.9% (239,574) and Latin America and the Caribbean 15.2% (214,522). Regarding mortality, the estimate in Asia was 32.1% (120,593), Europe 28.8% (108,088), Oceania 1.3% (4,767), Africa 12.6% (47,249), America North 9.9% (37,192) and Latin America and the Caribbean 15.3% (57,415). Estimated 5-year survival in Asia was 23.7% (1,176,781), Europe 37.8% (1,873,814), Oceania 1.8% (89,069), Africa 3.6% (178,197), America North 18.8% (929,921) and Latin America and the Caribbean 14.3% (709,119) [6].

Despite prevention and early diagnosis strategies, the results of survival analyses indicate that approximately 15% of patients diagnosed with PC may die as a result of this neoplasm [8,9,10]. Among the variables identified as important risk factors for the development of PC, the following stand out: I) age, as it generally affects men over 50 years of age and the risk of becoming ill increases with advancing age; II) family history, individuals with first-degree relatives with PC have approximately twice the risk of developing this neoplasm than the general population; and III) black race has higher incidence rates and more aggressive tumors [11].

Historically, it has been observed that the survival of patients with PC has improved. For example, in European countries (France, Wales, and England), at the end of the 1980s, five-year survival was 56%. In the same period in the United States of America (USA), the estimate was 84% localized PC, increasing to 94% in the 90s [9]. For tumors classified as low grade, survival reaches 100% of cases, while in more advanced cases this rate has shown a modest increase. This improvement in the survival rate is currently probably due to technological advances in early diagnosis and treatment [12], as well as through epidemiological studies that contribute to a better understanding of the prognostic factors of the disease [10,13].

Pre-treatment PSA assessment, degree of histological differentiation of biopsied tumor fragments, according to the Gleason score, and tumor staging are considered important clinical prognostic factors for PC, which indicate the best therapeutic choice for each patient [8,14, 15,16].

The use of time considered in epidemiological studies is extremely important, as it contributes to understanding the disease and related prognostic factors. Indirectly, it also allows evaluating advances in diagnostics and therapies, in the organization and quality of health services provided to these patients [17,18]. Survival analysis is also an important indicator for evaluating oncological results, as it estimates the system's capacity to provide quality care to patients [17].

Luizaga et al. [19], when evaluating PC survival rates in Brazil, showed a slight reduction in mortality. This is due to the early identification and treatment of PC that changed with the discovery of PSA. However, improved diagnosis in the detection of PC has consequently led to better treatment of patients with low-risk disease.

On the other hand, Hospital Cancer Records (RHC) are considered fundamental in structuring an information system on any type of neoplasm. However, sending these data is mandatory for hospitals qualified in specialized oncology care in the SUS and optional for hospitals that are not qualified [2,5], which implies limitations in PC screening by RHC and, consequently, controversial results. Furthermore, the approaches used to determine this rate did not consider the patient's age, general health status, response to treatment, and PSA, among other factors that can also affect the patient's prognosis [20,21].

Thus, well-conducted cohort studies are relevant to better characterize the survival of these individuals. Therefore, the objective of this research was to estimate survival and evaluate prognostic factors in patients with PC treated in an oncology hospital.

2. MATERIALS AND METHODS

2.1. Type of study

This is a retrospective cohort study with a sample of 3,450 male patients, aged between 42 and 93 years old, with PC. The study covers the period from 2009 to 2018, with follow-up until 2020 at HCM/CACON, Muriaé, Minas Gerais, Brazil. Data were collected from medical records and information in the RHC, spreadsheeted in the Excel/2020 program and a database was created for subsequent statistical analysis. All records resulting from the search were subjected to a separate screening assessment, and the data extraction instrument was previously tested with a smaller sample using a specific research protocol.

This hospital is outsourced by the Ministry of Health (MS), with approximately 85% of services provided by SUS. The majority treated at the hospital come from the Zona da Mata of Minas Gerais, and neighboring states, such as Rio de Janeiro, Espírito Santo, and Bahia.

The main objective of this research was to evaluate prognostic factors and survival rates in patients with PC, which required prolonged follow-up to obtain robust and significant data. Although the inclusion of more recent data after 2018 would be valuable, our current resources do not allow for a new study period or patient contact from 2020 without additional funding.

2.2. Development

To form the cohort for this research, patients diagnosed with CP, confirmed by anatomopathological examination, were selected. Information on anamnesis, diagnosis (anatomopathological examination), clinical evolution, and death were obtained from the medical records and RHC provided by the hospital. Patients considered eligible for the study contributed to the calculation of survival by those who were alive in the last record in the medical records researched. The rest were considered lost to follow-up.

For the analysis, the following variables were considered: age, race, family history of cancer, clinical staging, Gleason score (assessment of the degree of PC dedifferentiation by microscopy), PSA, initial treatment, post-surgery therapy, post-radiotherapy hormonal therapy, antiandrogenic hormonal therapy, biochemical recurrence and localization of metastases.

Biochemical recurrence was characterized by a PSA value >0.4 ng/ml in patients undergoing primary oncological treatments for PC, such as surgery (radical prostatectomy) or external beam radiotherapy [23,24,18].

2.3. Data analytics

Survival analysis was calculated using the Kaplan-Meier method and hypotheses of parallelismbetween different curves were tested using the log-rank [25]. The variables studied were categorized based on cutoff points (36, 48, and 60 months),after diagnosis and demonstrated analytically and descriptively through survival curves, according to the literature.

To analyze the prognostic factors associated with the tumor, hazard ratios (HR) and 95% confidence intervals were calculated, using Cox proportional hazards models which are frequently used to analyze survival data in medical research. This model describes the relationship between the incidence of the event (expressed by the risk function) and a set of covariates [26].

The hazard rate is the instantaneous probability of the event at a given time or the probability that an individual under observation will experience the event during a period centered around that point in time [26]. The outcome of death due to PC was presented accordingly.

For the final model, only variables that presented a statistically significant raw HR ($p<0.05$) and with more than 80% complete information were considered. Statistical analyses were performed using SPSS software version 23.0.

3 RESULTS AND DISCUSSION

3.1. Characteristics of the CP patient cohort

The results showed that the median follow-up time of the retrospective cohort was 3 years and 7 months (2009-2018), with a minimum follow-up of 11 months and a maximum of 10 years. The study evaluated 3,450 medical records and information from the RHC of patients with PC, which made it possible to obtain information on age in 100% of patients, race in 98.9%, family history of cancer in 62.4%, clinical stage in 91.2%, Gleason score in 97%, PSA in 85.4%, and metastasis location in 11.5% and patients without metastasis in 87.5% of the sample

Data regarding the type of treatment used after surgery and biochemical recurrence were obtained from 100% of the medical records and the RHC. The average age of the population was 72 years old, with the highest concentration of patients (58.1%) falling within the age range of 60 to 75 years old. The majority of patients were multiracial men (45.9%), without a family history of cancer (39.6%), clinical stage II (57.70%), low Gleason score <= 6 (54.31%), and PSA < 10 ng/ml (40.9%). (Table 1).

Surgery (radical prostatectomy) was the predominant initial treatment (58.6%), followed by hormone therapy (24.7%) and radiotherapy (16.2%). In postoperative treatment, isolated hormonal therapy was the most common (78.9%), followed by radiotherapy and concomitant hormone therapy (16.6%), and radiotherapy alone (4.3%). Among the patients who received post-radiotherapy hormonal treatment (88.32%), 88.0% received antiandrogenic hormonal

therapy (Leuprorelin (Eligard®) at some point during treatment (adjuvant, rescue or palliative).

The majority of patients (78.4%) did not experience biochemical recurrence, and 88.35% did not present metastasis. Among the metastases identified, bone metastases (10.17%) were the most common. (Table 1).

Table 1. Characteristics of the cohort of patients with prostate cancer

Age in years (median; p 25-p 75) (72; 62-74)		
Time (in months) since first diagnosis (median; p 25-p 75) (8,5; 5-26)*		
Variáveis	**Casos (n)**	**%**
Age (years)		
<60	627	18.00
60-75	2026	58.10
>75	832	23.90
	3,485	**100**
Race		
White	1,156	33.52
Black	681	19.75
Multiracial	1,601	46.43
Other	10	0.29
	3,448	**100**
Family history of cancer		
No history	1,381	63.53
Prior history	793	36.47
	2.174	**100**
Stanging		
I	362	11.60
II	1,801	57.70
III	650	20.82
IV	308	9.88
	3.121	**100**
Gleason Score		
Low (well differentiated <= 6)	1.836	54.31

Intermediate (moderately differentiated >=7)	1.017	30.08
High (poorly differentiated 8)	527	15.59
	3.380	**100**
PSA (ng/ml)		
<10	1.427	47.98
>20.01	998	33.56
10.01-20	549	18.46
	2.974	**100**
Initial Therapy		
Surgery (radical prostatectomy)	2,043	58.60
Hormone Therapy	861	24.70
Chemotherapy	16	0.50
Radiotherapy	565	16.20
	3,485	**100**
Therapy after surgery		
Hormone Therapy	1,489	78.99
Radiotherapy	82	4.36
Radio and Hormone Therapy	314	16.65
	1.885	**100**
Post-radiotherapy hormone therapy		
Not performed	66	11.68
Yes (performed)	499	88.32
	565	**100**
Anti-androgen hormone therapy		
Androcur	3	0.20
Bicalutamide	32	2.19
Cyproterone	16	1.09
Diethylstilbestrol	1	0.069
Flutamide	48	3.29
Zoladex® (Goserelin)	72	4.94
Eligard® (Leuprorelin)	1,281	88.04

Zometa	2	0.18
	1.455	**100**
Biochemical Recurrence		
Absent	1,506	78.40
Present	415	21.60
	1.921	**100**
Site of Metastasis		
Liver	5	0.15
Lymph nodes	20	0.57
More than one metastasis	23	0.66
Bones	351	10.17
Lung	3	0.08
No metastasis	3,048	88.35
	3.450	**100**

Source: [*]Research Data (2009-2018).
Caption: no information/not applicable: Race: 37; [b]Family history of cancer:1.311; [c]Clinical Stage (TNM Classification): 364; [Gleason] Score: 105; [e] PSA (ng/ml): 511;[adjuvant] therapy after surgery: 1.600; [g]Post-radiotherapy hormone therapy: 2.920; [h]Anti-androgen hormone therapy:2030; [i]Biochemical recurrence:1.564; [j]Site of metastasis: 35.

3.2. Survival

The results demonstrate a significant difference between the variablesin each of these parameters ($p<0.001$).

The analysis found that patients aged under 60 years had the highest survival rates, with 97% at 36 months and 96% at 48 and 60 months. Similarly, those with Gleason scores of less than or equal to 6 had a 98% survival rate at 36 months 97% at 48, and 96% at 60 months. Patients with stage I had the highest survival rate, with 99% at 36, 48, and 60 months, while those who received radiotherapy as their first treatment had a 97% survival rate at 36 months and 96% at 48 and 60 months. Patients with PSA levels <10 ng/ml had a 99% survival rate at 36 and 98% at 48 and 60 months.

On the other hand, patients with stage IV tumors had the lowest survival rate, with 60% at 60 months, followed by those with Gleason scores greater than or equal to 8, with a 67% survival rate at 60 months. The other variables analyzed did not show statistical significance in the estimated lifespan of the patients (see Table 2).

Table 2. The estimated survival at 36, 48, and 60 months and their respective 95% CI and the p-value of the Log-rank test of the epidemiological and clinical variables assessed in patients with prostate cancer.

Age / Time (months)	36 (IC 95%)	48 (IC 95%)	60 (IC 95%)	p-value	Log-Rank
<60	97 (-96.99)	96 (-95.98)	96 (-94.98)	< 0.001	64.1
60-75	96 (-95.97)	94 (-93.96)	93 (-92.95)		
>75	88 (-86.91)	85 (-82.88)	82 (-78.86)		
Gleason score / Time (months)	36	48	60	p-value	Log-Rank
<=6	98 (-97.99)	97 (-96.98)	96 (-95.98)	< 0.001	209
7	95 (-93.96)	92 (-92.95)	91 (-89.94)		
>=8	80 (-75.85)	73 (-68.79)	67 (-61.74)		
Staging / Time (months)	36	48	60	p-value	Log-Rank
I	99 (-97.100)	99 (-97.100)	99 (-97.100)	< 0.001	354
II	98 (-97.99)	97 (-96.98)	96 (-95.97)		
III	93 (-91.95)	90 (-88.93)	88 (-85.92)		
IV	71 (-65.78)	61 (-54.70)	60 (-52.69)		
First Therapy / Time (months)	36	48	60	p-value	Log-Rank
Surgery	97 (-96.98)	96 (-94.97)	94 (-93.96)	< 0.001	116
Hormone Therapy	86 (-83.89)	82 (-78.86)	79 (-75.83)		
Radiotherapy	97 (-96.99)	96 (-94.98)	96 (-93.98)		
Chemotherapy	91 (-75,100)	91 (-75,100)	91 (-75,100)		
PSA / Time (months)	36	48	60	p-value	Log-Rank
<10 (ng/ml)	99 (-98.100)	98 (-97.99)	98 (-96.99)	< 0.001	165
10.01-20 (ng/ml)	96 (-93.98)	94 (-92.97)	92 (-88.95)		
>20.01 (ng/ml)	86 (-83.89)	81 (-77.84)	78 (-74.82)		

Source: Research Data (2009-2018)

3.3. Epidemiological and clinical variables

To compare the survival curves obtained between the analyzed variables, the Kaplan-Meier method and the Log-rank test were used. The Log-rank test identified the presence of parallelism between the differences in the curves in pairwise comparisons. The results showed a significant difference in age, Gleason score, and PSA ($p<0.05$), indicating that the hypothesis of similarity in the survival curve was rejected. The global comparison between the curves in different stages rejected the hypothesis of similarity between the levels analyzed. However, in paired comparisons, the log-rank test identified the existence of parallelism between the curves of stages I and II and rejected the hypothesis of similarity between the

other curves. In the global comparison between the survival curves relative to the first treatment, the similarity hypothesis was also rejected. However, in the log-rank test for paired comparisons, the surgery/radiotherapy and hormone therapy/chemotherapy curves did not show significant differences (p>0.05), indicating the existence of parallelism between them.

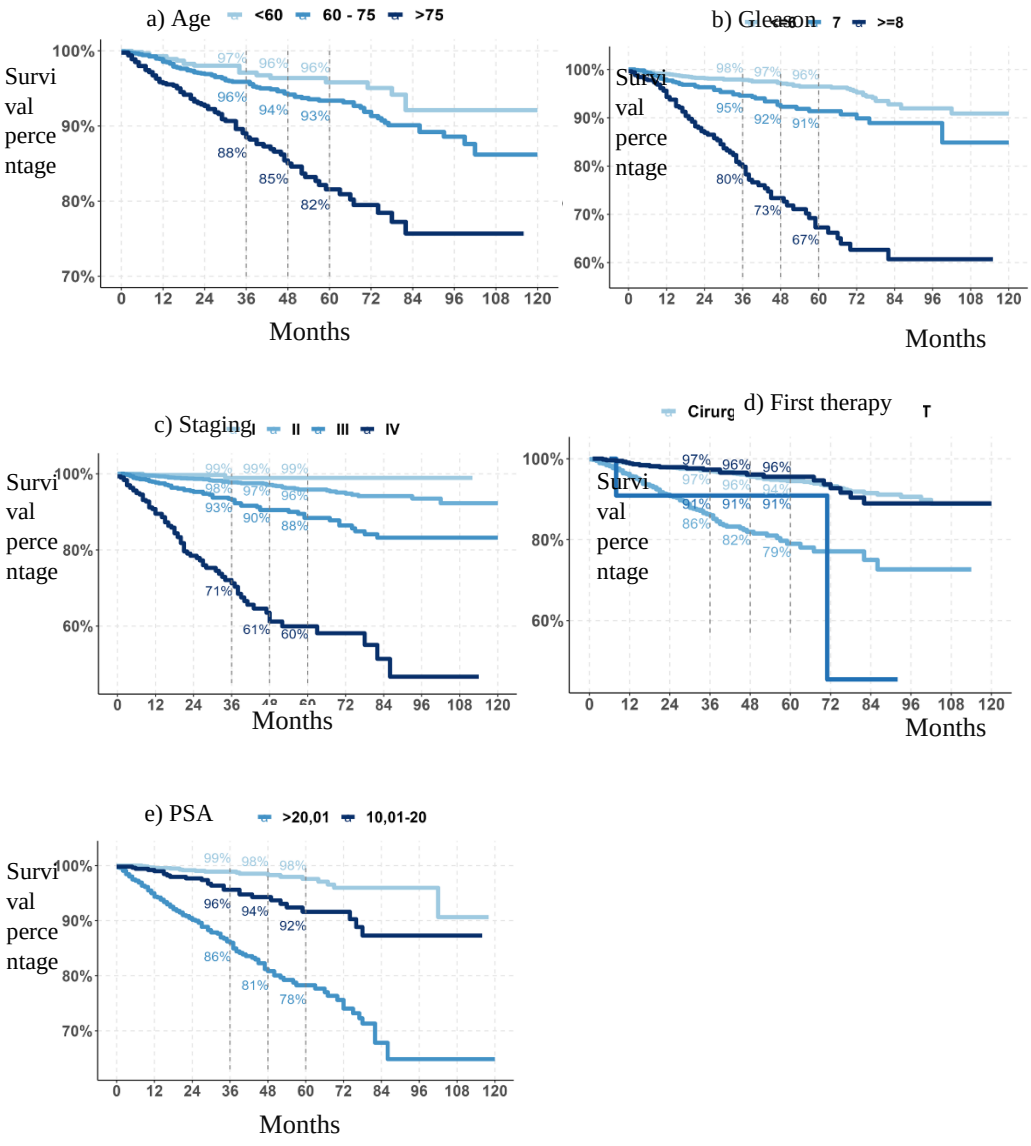

Figure 1: Kaplan-Meier curve of the epidemiological and clinical variables of the study of patients with prostate cancer: a) Age, b) Gleason score, c) Staging, d) First therapy (surgery), e) PSA levels.Surgery; HT = Hormone Therapy; RT = Radiotherapy; QT = Chemotherapy.

Table 3. Paired comparisons of the epidemiological and clinical variables studied according to the log-rank test.

	p-value	p-value	p-value	
Age	60-75	>75		
<60		0.043	< 0.0001	
60-75			< 0.0001	
Gleason score		7	>=8	
<=6		0.00014	< 0.0001	
7			< 0.0001	
Staging		II	III	IV
I		0.098	< 0.0001	< 0.0001
II			< 0.0001	< 0.0001
III				< 0.0001
First Therapy		Hormone Therapy	Radiotherapy	Chemotherapy
Surgery		< 0.0001	0.968	0.022
Hormone Therapy			< 0.0001	0.872
Radiotherapy				0.022
PSA		>20.01	10.01-20	
<10		< 0.0001	< 0.0001	
>20.01			< 0.0001	
p-value <=0.05	There is a difference in the survival curve (similarity hypothesis rejected)			
p-value > 0.05	There is no difference between the survival curves (parallelism)			

Source: Research Data (2009-2018)

3.4. Cohort

According to the hazard ratios (HR) calculated to analyze the risk ratios for death due to PC, patients aged over 70 years have a higher risk of death (4.21 times) compared to patients under 60 years of age. Patients with clinical stages III and IV are 3.27 and 14.73 times more likely (respectively) to die compared to those with stages I and II. Patients with intermediate (7) and high (8, 9, 10) Gleason scores are 2.05 and 7.84 times (respectively) more likely to die from PC than those with low scores. Furthermore, patients with PSA between 10.01 - 20 ng/ml and above 20.01 ng/ml have a higher risk of dying, with 3.12 and 10.55 times higher

risks (respectively) than those with PSA <10 ng/ml. Finally, the risk ratios showed that patients undergoing hormonal therapy and chemotherapy are 4.03 and 5.03 times more likely to die (respectively) than those undergoing basic treatment (surgery). Please refer to Table 4 for more details.

Table 4. Univariate analysis of the cohort of patients with PC treated at the HCM according to medical-biological variables

Variables	HR[a]	CI 95%[b]	p[c]
Age Group			
< 60 Years	Base Category		
60 - 70 Years	1.62	(1.03-2.62)	0.048
> 70 Years	4.21	(2.59-6.850)	<0.0001
Staging			
I + II	Base Category		
III	3.27	(2.22-4.80)	<0.0001
IV	14.73	(10.31-21.05)	<0.001
Gleason score			
Low (2, 3, 4, 5 and 6)	Base Category		
Intermediate (7)	2.05	(1.41-3.00)	0.0001
High (8, 9 10)	7.84	(5.63-10.92)	< 0.0001
PSA (ng/ml)			
≤10	Base Category		
10.01 - 20	3.12	(1.74-5.59)	<0.0001
>20.01	10.55	(6.60-16.89)	0.0001
Initial Therapy			
Surgery	Base Category		
Radiotherapy	0.97	(0.61-1.56)	0.926
Hormone Therapy	4.03	(3.03-5.43)	<0.0001
Chemotherapy	5.03	(1.23-20.48)	0.024

Legend. [a] Hazard Ratio obtained by the univariate Cox proportional hazards model; [b] 95% confidence interval; [c] Statistical Significance (p value).
Source: Research Data (2009-2018)

3.5. Prognostic factors in the cohort of patients with PC

The results of a study that used the Cox Proportional Hazards method to analyze the risk of death from prostate cancer are presented in Table 5. The study found that patients who are

over 70 years old have a 2.43 times higher risk of death than those who are younger than 60. Patients in clinical stages III and IV have a 1.93 and 5.34 times shorter survival, respectively, compared to those in stages I and II. Patients with a high Gleason score are 2.56 times more likely to die than those with a low score. Patients with a PSA level between 10.01 and 20 ng/ml are 2.10 times more likely to die than those with PSA ≤ 10 ng/ml and those with PSA > 20.01 ng/ml are at a higher risk by 3.57 times.Although intermediate Gleason score subcategories, chemotherapy, and antiandrogen hormone therapy showed statistical significance in the univariate analysis (Table 4), they did not demonstrate statistical significance (p>0.05) when tested in a multivariate model. Therefore, the final multivariate model included age group (>70 years), clinical stage (III and IV), high Gleason score, and PSA levels (>10.01 ng/ml).

Table 5. Multivariate analysis (final model) of prognostic factors in the cohort of patients with prostate cancer treated at HCM

Variables	**HR[a]**	**CI 95%[b]**	**p[c]**
Age Group			
< 60 Years	Base Category		
60 - 70 Years	1.282	(0.74-2.21)	0.37399
> 70 Years	2.434	(1.40-4.22)	0.00151
Staging			
I + II	Base Category		
III	1.931	(1.24-3.02)	0.00378
IV	5.342	(3.44-8.29)	<0.0001
Gleason score			
Low (2, 3, 4, 5 and 6)	Base Category		
Intermediate (7)	1.271	(0.81-1.988)	0.29305
High (8, 9 10)	2.561	(1.69-3.89)	<0.0001
PSA (ng/ml)			
≤10	Base Category		
10.01 - 20	2.104	(1.11-3.98)	0.02203
>20.01	3.574	(2.03-6.27)	<0.0001

Legend. [a] Hazard Ratio obtained by the univariate Cox proportional hazards model
[b] 95% confidence interval; [c] Statistical Significance (p value)
Source: Research Data (2009-2018)

4. DISCUSSION

The study shows that the survival rates over 5 years were higher than the rates indicated by MS. At a regional level, the survival rate was 94.6%, while the INCA estimated it to be 83.5%. The research cohort's highest survival rates in the same period (5 years) were 96% for patients below the age of 60, with a low Gleason score and radiotherapy as the first treatment. Additionally, the survival rate was 98% with PSA <10 ng/ml and 99% for stage I tumors. The study's results show that cancer patients living in developed and developing countries have a disparity between survival estimates, and this is because the prevalence rates in the latter are lower than those in developed countries.The biochemical recurrence rate was found to be 21.60% in the sample, while it was 11.90% in other studies in the literature. Additionally, the Cox proportional hazards model results showed that patients who were over 70 years of age had a greater chance of death. The study also found that younger patients tend to have more aggressive manifestations of the disease, leading to shorter survival. However, a cohort study by Niclis et al. showed a decreasing trend in mortality from PC in patients aged between 40 and 50 years, which could be related to the improvement of treatment conditions and not to the age of the patients.Recent studies indicate that the favorable trends in reducing PC mortality are attributable to better treatment and management of the disease, along with early diagnosis and PSA screening. Similar results were found in the literature, regardless of prognostic variables, with overall survival estimated at 93.4% at 5 years. However, more recent studies show that in addition to physical examination by digital rectal examination, the most used factor for diagnosing this neoplasm is PSA [32,33].According to the Cox proportional hazards model (final model), patients diagnosed with tumors in clinical stages III and IV are more likely to die than those diagnosed with tumors in stages I and II. These results are in line with previous literature data that indicate such tumors as a good prognostic factor, with few progression events for localized PC [10].The Cox proportional hazards model (final model) also indicates that patients with a Gleason score of ≥8 have a 2.58 times higher risk of dying than patients with a low score. These findings support previous studies that suggest a high Gleason score is a risk factor for more aggressive biological behavior and a worse prognosis in CP [14,9]. Advancements in technology for treatment and early detection have led to increased survival rates, highlighting the significance of analyzing this parameter for planning and strategic actions in the field of oncology [17,28,13]. These advancements have the potential to further improve the identification of men with low-risk diseases who can be appropriately treated through active surveillance. In the studied population, PC was more common in multiracial men with a mean age of 72 years, without a family history of PC, with stage II tumors, low Gleason scores, PSA levels <10 ng/ml, and who underwent radical

prostatectomy as their initial treatment.The analysis of prostate-specific antigen (PSA) has been a crucial factor in the screening for asymptomatic and symptomatic men with prostate cancer (PC). Since the end of the 1990s, it has contributed to an increase in the overall survival of patients with this neoplasm [15,18]. In Europe, the survival rate in 5 years was 56%, which increased to 86% and 95% in 2004 and 2006, respectively. However, PC has the lowest incidence rate among types of cancer in men, accounting for only 7% in the European Unionin 2021[30]. Despite the controversy surrounding screening for PC using PSA, the application of this diagnostic practice has led to a reduction in mortality rates by approximately 20% in recent decades [22]. The literature provides conflicting information about the prognostic value of pre-treatment PSA in predicting the biological aggressiveness of PC. Nevertheless, when combined with other prognostic factors such as clinical staging and Gleason score, it has enabled better risk stratification [23]. The results obtained in the Cox proportional hazards model (final model) suggest that PSA is an important prognostic factor. Patients with PSA levels between 10.01 and 20 ng/ml and >20.01 ng/ml have a higher probability of dying compared to levels ≤10 ng/ml. In patients with localized PC, race and family history did not show significant differences in estimating survival. However, a study by Costa et al. [28] revealed that black American patients had a worse prognosis compared to patients of other races.A study by Liu et al. found that patients with localized PC who had a family history of the disease had a 23% worse prognosis. Similarly, Costa et al. and Wolf et al. demonstrated a link between PC and familial cases of the disease. Although the majority of patients in the present cohort did not have a family history of PC, there were a significant number of medical records without such information (37.6%), which may have contributed to the higher data from patients without a history.The study on the overall survival of patients with PC shows that those who underwent radical prostatectomy had a better prognosis than those who underwent chemotherapy or antiandrogenic hormonal therapy as initial treatment. However, primary treatment did not appear to be a good prognostic factor for assessing survival in patients with PC.Another study showed that patients with PC treated with surgery had the highest survival estimates, while those who received radiotherapy had the worst prognosis. The selection bias of patients undergoing surgery may explain the favorable survival rate associated with surgery as an initial treatment.The limitations of this study include a lack of data in medical records and difficulty in collecting data, as much of the information on elderly patients was found in physical medical records and the most recent information in electronic medical records.Future work should focus on collecting more comprehensive information and data in medical records to ensure a more complete analysis.A

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4. CONCLUSION

After analyzing the data, we were able to identify the factors that affect prostate cancer prognosis. The study found that younger patients (under 60 years) with a low Gleason score, first treatment using radiotherapy, PSA levels under 10 ng/ml, and stage I tumors had higher 5-year survival rates compared to the national and global averages. This information can help evaluate the effectiveness of early diagnosis and treatment methods used in public cancer treatment facilities. It can also inform the development of new control strategies and health promotion programs aimed at reducing morbidity and mortality rates caused by prostate cancer.

CONSENT

“The authors declare that 'informed consent was obtained from the patient (or other approved parties). A copy of the written consent is available for review by the editorial office/editor-in-chief/editorial board members of this journal.”

ETHICAL APPROVAL

All authors declare that all data were examined and approved by the appropriate ethics committee and were therefore carried out by the ethical standards set out in the 1964 Declaration of Helsinki and the research was carried out following the criteria set out in Resolution Number 466/ 2012 from the National Health Council (CNS). The study was approved by the local research ethics committee under number CAAE 42638620.3.0000.5138.

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