Original Article

Pilot Study on the Locoregional Demographics of Prostate Cancer in River State, Nigeria

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Abstract

Background: The aetiology of prostate cancer is a subject of intense research and has been attributed to several risk factors. Geographical variations have also been observed with high incidence in western countries and rising rates in developing countries. This study aims to evaluate the locoregional distribution of histologically confirmed prostate cancer patients and discuss the risk factors for the observed variations according to their Local Government Areas (LGA) in Rivers State.
Methodology: This is a descriptive retrospective study on patients with histologically confirmed prostate cancer from three hospitals that take urology referrals over 10years. The patient's hospital records were obtained, and records of their ages, permanent place of residence, prostate biopsy histopathology reports, and Gleason's scores were extracted. These data were collated and analyzed using SPSS version 20.
Results: There were 278 patients managed over a 10year period with a mean age of 68.39years+_10.06. Prostate cancer was the commonest in the 60-69year age group (37.1%), followed by the 70-79year range. The high-risk, poorly differentiated cancer (Gleason 8-10; ISUP 4,5) was the commonest, followed by the intermediate-risk cancers (Gleason 7; ISUP 2,3). Port Harcourt (41.0%) and ObiaAkpo (36.0%) Local Government Areas (LGAs) in Port Harcourt City had the highest frequencies of prostate cancer. There was no relationship between age and Gleason's score in the men.
Conclusion: Prostate cancer appears more common in the LGAs in Port Harcourt City compare to the semi-urban and rural LGAs in Rivers State. High-grade cancers are more frequent both in rural and urban LGA. High Gleason score cancers appear more frequently in the metropolitan Port Harcourt City than rural LGAs.
Keywords: Prostate Cancer; Demography; Distribution; Gleason's Score.

Introduction

The aetiology of prostate cancer (PCa), though unknown, is a subject of intense research and has been attributed to several risk factors, including race, diet, serum androgen level, family history, and environmental factors. [1,2,3] Geographical variations have also been observed with high incidence in western countries and lower rates in developing countries.[1] Adaptation to Western influences with immigration and or urbanization has frequently been associated with an increased incidence in the same racial populations, suggesting that factors in the lifestyle change are possibly responsible for the increased risk. For example, studies have found a significant increase in the incidence of prostate cancer among African-

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Americans who migrated to the United States of America compared to Africans living in Africa. A similar pattern was also observed among Chinese living in the USA vis-à-vis their counterparts living in China.[4,5] A study in Port Harcourt, Rivers State, Nigeria, investigated the ethnic variations among prostate cancer patients but did not put into consideration their locoregional distribution and place of residence.[6]This study aims at evaluating the locoregional distribution of patients with histologically confirmed prostate cancer and the risk factors for the observed variations according to their Local Government Areas (LGA) in Rivers State.

Methods and Methodology

This is a descriptive retrospective study on patients with histologically confirmed prostate cancer from three hospitals that take urology referrals over a 10year period from 2011- 2020: University of Port Harcourt Teaching Hospital, Sophia Hospital, and Rosivylle Clinic and Urology Centre. The three Centers receive urology referrals from Port Harcourt and environs. Port Harcourt is a coastal city and capital of Rivers State, located in Southern Nigeria. The patients' hospital records were obtained, and their ages, permanent place of residence, prostate biopsy histopathology reports, and Gleason's scores were extracted. These data were collated using Microsoft Excel 2016 version (Microsoft Corporation, Redmond, WA, USA), and they were subjected to analysis using SPSS version 20.

Results

There were 278 patients managed over a 10year period with a mean age of 68.39years+_10.06 and median age of 67.50years. Prostate cancer was most frequent in the 60-69year age group (37.1%), followed by the 70-79year range. The high-risk, poorly differentiated cancer (Gleason 8-10; ISUP 4,5) was the commonest, followed by the intermediate-risk cancers (Gleason 7; ISUP 2,3). Port Harcourt (41.0%) and Obia Akpo (36.0%) Local Government Areas in Port Harcourt City had the highest frequencies of prostate cancer. There was no relationship between age and Gleason's score in the men.

Table 1: Characteristics and Gleason's score of men with prostate cancer

Variable	N	%
Age group		
40-49	3	1.1
50-59	47	16.9
60-69	103	37.1
70-79	87	31.3
⩾80	38	13.6
Grading (Gleason's score)		
Well-differentiated (2-6)	52	18.7
Moderately differentiated (7)	46	16.5
Poorly differentiated (8-10)	100	36.0
Unknown	80	28.8
Total	**278**	**100.0**

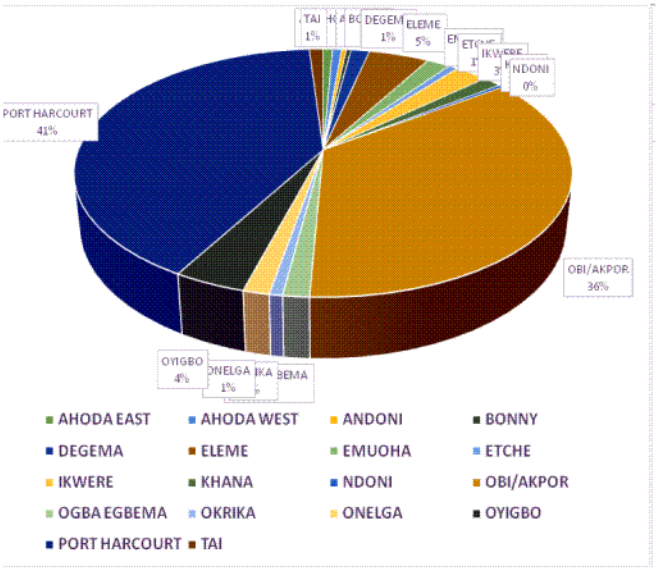

Figure 1: Distribution of prostate cancer patients by Local Government Areas in Rivers State.

Table 2: Gleason's score distribution among prostate cancer patients.

Age group	Grading (Gleason score)							
	Well-differentiated (2-6)		Moderately differentiated (7)		Poorly differentiated (8-10)		Unknown	
	N	%	N	%	N	%	N	%
40-49	0	(.0)	1	(2.2)	0	(.0)	2	(2.5)
50-59	6	(11.5)	8	(17.4)	14	(14.0)	19	(23.8)
60-69	22	(42.3)	20	(43.5)	37	(37.0)	24	(30.0)
70-79	15	(28.8)	10	(21.7)	39	(39.0)	23	(28.7)
>80	9	(17.3)	7	(15.2)	10	(10.0)	12	(15.0)
Total	**52**	**(100.0)**	**46**	**(100.0)**	**100**	**(100.0)**	**80**	**(100.0)**

Chi-square =14.41, p-value = 0.275

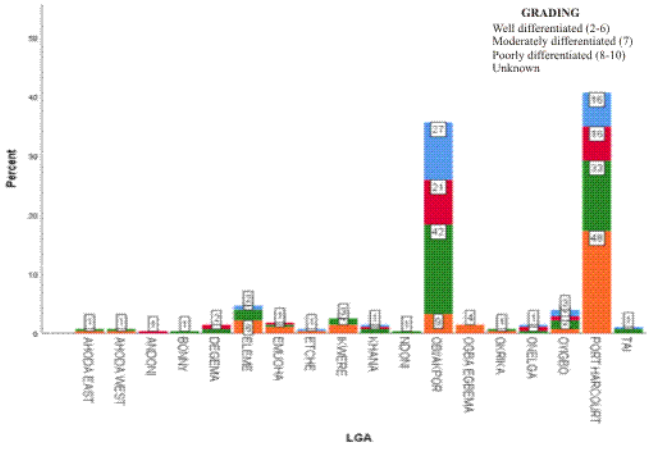

Figure 2: Gleason score distribution among prostate cancer patients by Local Government Area in Rivers State.

Discussion

Prostate cancer is the second most common cancer in men on the planet after lung cancer and was responsible for about 4% of all male cancer deaths in 2018.[7,8] Men of African descent, especially African Americans, have the highest incidence compared to Caucasians and Asian men, with 158.3 new cases diagnosed per 100,000, and about twice the mortality in Caucasians. [1]The reasons for this disparity have been attributed to differences in social, environmental, and genetic factors. African Americans also have a higher disease burden with higher grades, elevated prostate-specific antigen (PSA) levels, and higher mortality rates.[1,8] In Africa, studies indicated that compared to their North African counterparts, blacks in sub-Saharan Africa also have a higher disease burden, higher PSA, and disease-related mortality.[9,10]

The geographical incidence of PCa has been inconsistent and sometimes undependable, and the incidence of this deadly condition in most African countries is less than what has been reported.[1] This may be attributed to shorter life expectancy in Africa, suboptimal testing, poor access to health facilities.[1,8,9]

Port Harcourt is the oil-rich capital city of the coastal Rivers State in Southern Nigeria with a heterogeneous and diverse population. In our study, the mean age of the patients was 68.39year, with the 60-69years age group having the highest frequency of prostate cancer (Table 1). This is similar to a study among African American men where the average age at diagnosis was 66years.[1]

Our study indicated that the Port Harcourt Local Government (PHALGA) and ObioAkpor Local Government Areas, both in the capital city of Port Harcourt, had the highest frequency of prostate cancer compared to the rural and suburban parts of the state (Figure 1). There are several possible explanations for these observations.

The risk factors that have been linked to prostate cancer include increased consumption of saturated animal fat and red meat, lower intake of fruits, vegetables, vitamins, obesity, physical inactivity, inflammation, hyperglycemia, infections, and environmental exposure to chemicals or ionizing radiation, more peculiar with city dwellers than suburban and rural dwellers [2,11,12].

Chu et al.[4] observed that African Americans in the United States have a 40-fold higher incidence of prostate cancer when compared to those living in Africa. A similar pattern was reported by Hsinget al. in 2000 [5] among Chinese living in the USA have a 16-fold increased incidence of prostate cancer compared to those Chinese living in China. These findings are clear indications that environmental factors play an essential role in the pathogenesis of prostate cancer.

Increased saturated fat intake in butter, cheese, cake, snacks, and fried food is generally more associated with the city and urban dwellers. It has been speculated to be a risk factor for prostate cancer. Consumption of a large amount of saturated fat from animal sources has been demonstrated to lead to the proliferation of prostate cancer cells by increasing the circulating levels of testosterone.[13,14] A study that showed that vegetarians had lower levels of circulating serum testosterone [15-17] seems to lend credence to this observation. Saturated fats are also found to cause oxidative stress in rats and increase the production of reactive oxygen species, which attack cells and cause DNA damage that is a precursor for carcinogenesis.[18]

In addition, red meat consumption has been associated with prostate cancer[19]. Rohrmannet al. [20] showed that men consuming five or more servings

of processed meat per week had a higher risk of prostate cancer when compared with men who took less than one serving per week. Also important is the cooking temperature as heating food at high temperatures >125°C, such as in grilling and barbecue, could cause the formation of aromatic hydrocarbons, N-nitroso compounds, and mutagenic heterocyclic amines[21] that can cause lipid peroxidation and DNA damage by the production of free radicals.[22]

Increased intake of milk and calcium, either from supplements usage, common among city dwellers, has been largely associated with an elevated prostate cancer risk.[29,23] A study that followed up about 47,885 men over 24years found an association between high calcium intake with prostate cancer.[24]Generally speaking, dairy products are more available and affordable in towns and cities with better supply chains and retail outlets. City dwellers have higher incomes and can generally afford milk compared to people in rural areas.

However, protective lifestyles, behaviours, and dietary habits could account for the observed lower incidence of prostate cancer in rural areas. Fresh fruits and vegetables are generally more available in rural and semi-urban areas. Consumption of vegetables and fresh tomatoes may have some benefits in preventing prostate cancer. Crucifers or *Brassica* vegetables such as broccoli, brussels sprouts, cauliflower, cabbage, and turnips seem to reduce prostate cancer risk.[25]This antimitotic activity is thought to be mediated by phenylmethyl isothiocyanate, sulforaphane, phytochemicals, and indole-3-carbinol[25]. Some studies in the United States on a diet rich in these vegetables have shown evidence for the protective effects against prostate cancer[26]. These findings are, however, refuted by other studies.[27,28]

Tomatoes contain high levels of lycopene which are potent antioxidants and exhibit cancer-protective activities. Intake of lycopene has been associated with a reduced risk of prostate cancer.[29,30] Another effect that may add to this anti-prostate cancer activity is that lycopene also acts on the androgen receptors and reverses the effects of dihydrotestosterone, inhibits insulin growth factor-1, stimulation through Akt and GSK3β and tyrosine phosphorylation of GSK3.[30]Venkateswaran and Klotz[31] in their study with transgenic mice showed that lycopene produced this observed benefit in reducing prostate cancer incidence only when selenium and vitamin E was added. Another study, The Health Professional Follow-up Study, found a decreased risk with 2-4 servings of tomatoes per week. Tomato product consumption and lycopene intake were associated with a reduced risk of prostate cancer.[32]

Finally, obesity and sedentariness are generally more common in the cities than in rural areas. Both obesity and physical inactivity have been linked to advanced and aggressive prostate cancer.[32,33] Suggested reasons include the presence in obese people alteration of circulating levels of metabolic and sex steroid hormones associated with the development of prostate cancer.[34]

The insulin resistance in the obese leads to chronic hyperinsulinemia that promotes cell growth and proliferation, potentially leading to prostate cancer initiation and progression.[35]Additionally, Keogh and McLeod found that veterans who exercised had a significantly lower risk of prostate cancer.[36] Another study found that patients with advanced prostate cancer who exercise regularly had lower PSA levels and delay in initiating androgen deprivation therapy (ADT) by two years and had a lower risk of high-grade disease than less active peers[36].

Conclusion

Prostate cancer appears more common in the urban LGAs in Port Harcourt City compared to the semi-urban and rural LGAs in Rivers State. High-grade cancers are more frequent both in rural and urban LGA. High Gleason score prostate cancers appear more frequently among Port Harcourt City dwellers than ruralLGAs. Adoption of Western dietary habits could be a factor contributing to the observed differences.

Limitations

This is a retrospective study with relatively small sample size. Larger prospective studies and randomized control trials are required to assess the impact of regional demographics on the risk of prostate.

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Conflict of interest: None

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