Original Article

Iraqi National Journal of Medicine. January 2024, Volume 6, Issue 1

Relationship between ABO blood type and clinical–pathological characteristics with prostate cancer patients in Khartoum state, Khartoum, Sudan

Wafa Mobarak Ahmed Ali [1], Asim Alaaedin Osman [1,2], Gad Allah Modawe [3]

[1] International university of Africa, faculty of medicine, department of human physiology, Khartoum, Sudan, [2] University of Gadarif, faculty of medicine, department of human physiology, Gadarif, Sudan, [3] Omdurman islamic university, faculty of medicine and health sciences, department of biochemistry, Omdurman, Sudan.

ABSTRACT

Background: Recent studies have demonstrated the association between ABO blood group and prostate cancer (PC), as well as the various factors associated with PC, including age, family history, ethnicity, and certain viruses. **Aim:** To demonstrate the association between ABO blood groups and PC and to correlate it with the demographic and clinical features of our studied population. **Methods**: A descriptive cross-sectional hospital-based study was conducted at the Radiation and Isotopes Center—Khartoum (RICK) in Khartoum state from April 2018 to April 2019. From a study population of 389 PC patients (RICK), a total of 101 were selected. Data was analyzed using SPSS version 21. **Results**: The mean age of prostate cancer was 66.3 ± 7.8 years; hypertension was the most common chronic disease, affecting 62.3% (63) of patients. Prostate-specific antigen levels increased by more than 10 ng/ml among 74.3% (75) of PC patients. Patients with blood group O had slightly more than one-third, or 37.6% (38), whereas patients with other blood groups had similar percentage ranging from 20% to 22%. No significant relationship was found between ABO blood groups and clinical–pathological characteristics with PC (*P*-value = 0.067). **Conclusion**: Our study provides evidence of an association between ABO blood group and clinical–pathological features of PC, hypertension was common in patients with ABO blood group, and there was no significant relationship between ABO blood group and clinical–pathological characteristics of PC.

Keywords: ABO blood group, prostate cancer, clinical pathology, Sudanese

Corresponding author: Gad Allah Modawe. E-mail: gadobio77@oiu.edu.sd
Disclaimer: The authors have no conflict of interest.

DOI: https://doi.org/10.37319/iqnjm.6.1.5
Received: 2 Apr 2023 Accepted: 26 Jul 2023 Published online: 15 Jan 2024

INTRODUCTION

Prostate cancer (PC) is considered the most common cancer in Western countries and represents the second leading cause of cancer-related mortality among men.[1] Various factors were proven to be associated with PC and increase an individual's susceptibility to acquire this disease, including age, ethnicity, family history, and certain viruses. The term "familial predisposition" suggests the genetic component that can be inherited from the parents and expressed in the offspring.[2,3] ABO blood-grouping system is hereditary, and its antigens

are highly expressed in the red blood cells and the epithelial and endothelial cells.[4] These antigens play a critical role, especially in maintaining membrane integrity, transportation, and adhesion.[5] Interestingly, the association between ABO blood groups and cancer was first demonstrated by Aird and associates,[6] when they demonstrated the association between ABO blood group and risk of gastric cancer. Additionally, recent studies demonstrated the association between ABO blood group and various cancers, including pancreatic,[7] ovarian,[8] kidney,[9] and skin.[10] Recently studies that to identify the mechanism of association of ABO blood groups and increased risk of cancer including inflammation, immune surveillance for cancer cells, intercellular adhesion, and membrane signaling.[11] To date, numerous studies have been conducted to investigate the possible association between ABO blood groups and PC, but their results are controversial because some studies positively agreed that there was an association, whereas others demonstrated that there was none.[12,13] However, in Sudan, to the best of our knowledge, not enough studies have been conducted to demonstrate the association between ABO blood group and PC. Therefore, this study aims to demonstrate the association between ABO blood groups and PC and correlate it with the demographic as well as the clinical features of our studied population.

MATERIALS AND METHODS

A descriptive cross-sectional hospital-based study was conducted at the Radiation and Isotopes Center—Khartoum (RICK) in Khartoum state from April 2018 to April 2019. PC patients were diagnosed using laboratory, x-ray, and ultrasound examinations (RICK). Other types of examinations (RICK) were excluded. The data was collected by direct interview using the checklist for the targeted population. The total number of PC patients diagnosed during one year from April 2018 to April 2019 was 389: one-quarter of the patients were chosen randomly using blood samples and 10% were withdrawal patients (N = 101). Data was entered and analyzed using SPSS Version 21, frequency tables were generated for the answers to the checklist, and analysis of variance was generated to measure the significant difference (using descriptive statistics, *t*-test, chi^2 test, regression, and odds ratio) between clinical–pathological characteristics with PC patients. Letters of approval were obtained from the International University of Africa, Khartoum State Ministry of Health Research Department, and RICK. Before conducting the study, the proposal was approved by the ethical committee of the International University of Africa and the lab at which the study was conducted; written consent was attached along with the checklist (participation was voluntary).

RESULTS

The baseline demographic, clinical characteristics and laboratory findings of the enrolled subjects are summarized in Table 1, showing the distribution of 101 pathologically confirmed PC patients (male, with a mean age of 66.3 ± 7.8 years). The study group had at least 1 chronic condition, with 62.3% having hypertension, 30.6% having diabetes mellitus, and 15.8% having hypothyroidism. The mean prostate-specific antigen (PSA) level was 14.8 ± 9.7 ng/ml, ranging from 2.3 to 80.0 ng/ml; the mean duration of PC disease was 21.5 ± 8.4 months, ranging from 4 to 41.7 months; and 89.1% of patients had PC >12 months. The O +ve blood group had the highest frequency, at 25.7%; followed by AB +ve, 20.8%; B +ve 15.8%; A −ve 12.9%; O –ve 11.9%; A, B, and AB rhesus –ve, 7.9%–4.0%. Table 2 summarizes the evaluation of the clinical–pathological characteristics according to ABO blood groups. All PC patients were divided into two groups: low–middle-risk group (n = 26) and high-risk group (n = 75). According to PSA level, low–middle risk is defined as PSA ≤ 10 ng/ml and high risk as PSA > 10 ng/ml. The frequency of high-risk PC incidence was high in O +ve blood group at 18.8%, followed by AB +ve 13.9%, whereas in 0.9% of patients and low–middle risk of PC, the common blood groups were AB −ve and O −ve, respectively. Conversely, there was no significant difference between ABO blood groups regarding PSA (p=0.067). Univariate analysis for PC patients with demographic and clinical–pathological characteristics. As summarized in Table 3, men with blood group O appeared to be significantly correlation with PC (odds ratio (OR) = 2.72, 95% confidence interval (CI) 1.27–5.83, P = 0.01), and the PSA level (OR = 5.00, 95% CI = 2.69–9.28, P < 0.0001) to be statistically significant. However, patients with hypertension, diabetes mellitus, hypothyroidism, PC duration, and other phenotypes of the ABO blood group were not associated with the risk of PC.

Table 1: Baseline characteristics of prostate cancer (PC) patients

Variables	All PC subjects (*n* = 101)	
	n	%
Demographic characteristics		
Age group		
≤50–59 years	23	22.8
60–69 years	37	36.6
≥70 years or more	41	40.6
Mean ± SD	66.3 ± 7.8 years	
Chronic disease		
Hypertension	63	62.3
Diabetes mellitus	31	30.6
Hypothyroidism	7	7.1
Clinical–pathological characteristics		
Prostate-specific antigen level at diagnosis (ng/ml)		
Low–middle risk (≤10 ng/ml)	26	25.7
High risk (>10 ng/ml)	75	74.3
Mean ± SD	(14.8 ± 9.7 ng/ml)	
Duration of PC		
≤12 months	11	10.9
>12 months	90	89.1
Mean ± SD	(21.5 ± 8.4 months)	
ABO blood group		
A +ve	8	7.9
A –ve	13	12.9
B +ve	16	15.8
B –ve	4	4.0
AB +ve	21	20.8
AB –ve	1	1.0
O +ve	26	25.7
O –ve	12	11.9

Table 2: Cross-tabulation of prostate-specific antigen (PSA) of prostate cancer patients stratified by ABO blood groups

ABO blood group	Level of PSA		*P*-value
	Low–middle risk (*n* = 26)	High risk (*n* = 75)	
A +ve (*n* = 8)	2 (1.9%)	6 (5.9%)	0.067
A –ve (*n* = 13)	3 (2.9%)	10 (9.9%)	
B +ve (*n* = 16)	5 (4.9%)	11 (10.8%)	
B –ve (*n* = 4)	0 (0.0%)	4 (3.9%)	
AB +ve (*n* = 21)	7 (6.9%)	14 (13.9%)	
AB –ve (*n* = 1)	1 (0.9%)	0 (0.0%)	
O +ve (*n* = 26)	7 (6.9%)	19 (18.8%)	
O –ve (*n* = 12)	1 (0.9%)	11 (10.8%)	

Table 3: Univariate analysis for prostate cancer (PC) patients with demographic and clinical–pathological characteristics

Variables	Univariate model		
	OR[1]	95% CI[2]	*P*-value[3]
Age	–	–	0.608
Hypertension	0.57	0.33–1.30	0.274
Diabetes mellitus	1.67	0.51–3.77	0.329
Hypothyroidism	0.71	0.23–2.32	0.496
PSA level	5.00	2.69–9.28	<0.0001
Duration of PC	0.61	0.49–1.54	0.543
Blood group A	1.13	0.37–3.32	0.820
Blood group B	1.04	0.34–3.14	0.949
Blood group AB	0.52	0.23–1.61	0.198
Blood group O	2.72	1.27–5.83	0.01

[1]Odds ratio, proportion of contribution to explain the outcome variable; [2]95% confidence interval for the odds ratio; [3]*P**-value <0.05, ≥statistical significant.

DISCUSSION

The role of inheritance in PC development has been clearly established, especially after the identification of many genes.[14] The association between ABO blood group antigens and malignancy was demonstrated a long time ago, yet the role of the ABO blood group in cancer risk remains challenging.[15] This study evaluated the association of ABO blood groups and clinical–pathological features, including the risk of PC from RICK patients. PC ranked first among all cancers in Sudanese men[16.17] and is the second most common cancer worldwide and the most common one in more developed regions.[2] Age is one of the strongest risk factors for PC, as about two-thirds of all PC cases diagnosed are men aged ≥65 years, representing approximately 85% of the total cases diagnosed. It has a much lower incidence in men <50 years (<0.1% of cases). In contrast to our finding, 40.6% of studied PC cases aged ≥70 years. Similar findings were also reported in studies by Taitt,[2] Moawia,[16] Pettersson,[17] and Gorish et al.[18] conducted in African countries, including Sudan. There is a vast difference in incidence rates among different ethnic groups. Asia has the lowest rates, especially in China, Japan, and India, whereas African and African American men have the highest rates.[2] Nearly one-third (30.5%) of elderly men with incident PC have at least 1 preexisting chronic condition out of 16 included in the Charlson Comorbidity Index.[19] Regarding the types of chronic

conditions, in this study, we found that hypertension was present in 62.3% of PC patients followed by 30.6% diabetes and 15.8% hypothyroidism. PSA is a protein made by cells in the prostate gland (both normal cells and cancer cells). Many doctors use a PSA cutoff point of 4 ng/ml or higher when deciding whether a man might need further testing, while others might recommend starting at a lower level, such as 2.5 or 3 ng/ml. Using these cutoffs detects most cancers and helps some men avoid unnecessary biopsies.[20] The mean PSA level among the study group was 14.8 ± 9.7 ng/ml, ranging from 2.3 to 80.0 ng/ml, and the PC disease duration was 21.5 ± 8.4 months, ranging from 4 to 41.7 months, of whom 89.1% of patients suffer from PC for >12 months. This finding was comparable with other studies conducted by Joh et al.[9] and Huang et al.[11] in China. In our study, PC patients with O +ve blood group had high frequency at 25.7%, followed by AB +ve 20.8%, B +ve 15.8%, A −ve 12.9%, O −ve 11.9%, and A, B, and AB rhesus −ve 7.9%–1.0%. This was also reported by previous studies from other countries.[21,22] Several studies have been conducted to determine the possible relationship between ABO blood groups and cancer; the frequently studied cancers are breast cancer, gastric cancer, lung cancer, and bladder, prostate, and kidney cancers.[17,18] In our study, PC patients were grouped into two, low–middle risk and high risk, regarding PSA level and then the association of ABO blood types and clinical–pathological features in the two groups were analyzed. Few studies have been reported on the relationship between ABO blood groups and risk of aggressiveness of PC. In our study, the association of ABO blood groups and rhesus distribution of patients in the two groups were as follows: the frequency of high-risk PC incidence was high in O +ve blood group at 18.8%, followed by AB +ve 13.9%, while in 0.9% patients and in low–middle-risk PC patients, the common blood groups were AB −ve and O −ve, respectively. There was no significant difference between ABO blood group regarding PSA (P = 0.067). Conversely, a study by Rummel et al.[29] conducted in the United States reported that there was no association between blood type and PC risk, but whether loss of antigen expression increases with tumor progression or invasion is controversial.[23] Also, recent two studies demonstrated that there is no association between ABO blood type and risk of aggressive PC.[22,24] Most of the patients in our study had O blood subtype and the patients with AB −ve and B −ve blood groups constituted the lowest percentage (0.0%–3.9%), which is in accordance with the studies conducted in the Turkish Population by Zhang et al. and Güner et al.[25,26] Also, 49.5% and 20.8% of the PC patients in the high-risk and low–middle-risk groups of PSA level were Rhesus (+ve). In recently published studies, a higher incidence of increased frequency of B blood subtype was observed in PC patients demonstrating the risk for PC being significantly lower in patients with blood group O, which is not in accordance with the study by Zhang et al.[26] The available evidence on the prognostic value of ABO blood group in patients with PC has been conflicting. Thus, it could be hypothesized that the genetic background associated with this blood group might predispose those patients who develop PC to a more favorable prognosis. The association of PC and blood group had different degrees in various studies: by univariate analyses, blood groups were independently correlated with the presence of high-risk PC. Our study showed that the presence of O-antigen is significantly (P-value = 0.01) related to the high risk of developing PC. On the other hand, other studies observed no association with O blood group,[13] whereas our findings are similar to those of previous studies,[27,28] which reported positive associations between type A and risk of prostate carcinoma.[26] Different studies suggested that blood type A group was a risk factor for the development of cancer due to observed over-representation rates of blood type A group compared to control populations.[22,24] The blood groups may have a connection with other diseases: blood type A has been proved to be a risk factor for stomach cancer and blood type O may protect people from pancreas cancer.[24] The possible reasons for the heterogeneity across studies include the use of retrospective cases or other differences in population characteristics. Although the study design is different, studies on other cancer fields, including pancreatic, gastric, breast, colorectal, ovarian, and esophageal, have revealed that O blood type decreased cancer risk compared with non-O blood type.[17] Moreover, our study proved that in PC patients, non-O blood type was strongly and positively associated with high risk,[23,26] which was independent of other confounders, including the established PC risk factors, such as PSA and P duration and at least one of chronic diseases. Therefore, our data extended previous studies and provided new information regarding the clinical application of ABO blood groups. These results suggest that Sudanese men with O blood type are predisposed

to develop prostatic cancer. However, these findings should be supported by further studies conducted with a large number of participants.

CONCLUSION

Our study provides evidence of an association between the ABO blood group and clinic pathological features of PC; hypertension was more common among patients with ABO blood groups, but there was no significant relationship between ABO blood group and clinical–pathological characteristics with PC.

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