Original Research Article

ABO blood type and association with various cancer types: A retro- prospective study from Southern India in a tertiary care setting

Ragupathi Siddarth[1], Jagadeesan Dhanasekaran[2], Sahadevan Vijay[3*]

[1]Associate Professor, Department of Radiology, Vinayaka Mission's Medical College and Hospital, Vinayaka Mission's Research Foundation, Karaikal, India

[2]Assistant Professor, Department of Radiology, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai, India

[3]Associate Professor, Department of Radiology, Vinayaka Mission's Medical College and Hospital, Karaikal, India

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Abstract

Objective: The role of ABO blood group in cancer biology has been intensely studied by several investigators, and it is now widely recognized that ABO antigens are associated with the risk of developing several types of tumours, namely pancreatic and gastric cancers. Aim of our study is to find out the association of ABO blood type with different type of cancer based on site and histology**. Materials and methods:** Ethical approval was obtained, Patients diagnosed of carcinoma coming to radiology department for CECT was included and those with previous history of surgery done for carcinoma, follow up cases coming for CT scans were excluded**. Results:** Out of 501 participants, the cancer of digestive system was the most frequent diagnosis that accounted for 54% of total cancer cases, followed by genitourinary system (32%) and respiratory system (10%). Cancer of the colorectal region was the most common cancer diagnosis (accounting for 22% of total cancers), followed by stomach (10%), ovary (9%) and cervix (8%). By histology, adenocarcinoma accounted for 54.5% of total histologically confirmed cancer cases while squamous cell carcinoma and carcinomas accounted for 12% and 9% respectively. The remaining 24% of cancer cases consisted of cases with other histology types. **Conclusion:** The results were different from those observed in western and Asian population. So, further cross section/ cohort studies are warranted across Pan India to know the association and variation in risk of cancer types with ABO blood group

Keywords: ABO blood type, Adenocarcinoma, Indian Population, Association.

Introduction

Among human blood group systems by the far most important is The ABO blood group and was discovered by Karl Landsteiner in 1901. These antigens are expressed on the surface of many human cells and tissues, including erythrocytes, epithelia of gastrointestinal tract, bronchopulmonary and urogenital tract [1]. It is also expressed in the sensory neurons, platelets, and the vascular endothelia. It is characterized by presence carbohydrate moieties on the surface of erythrocytes attached to protein backbone called H antigen [2]. Presence of Antigen A/ Antigen B determines the blood group of the patient. Blood group type A people have Antigen A with Antigen B and vice versa for blood type B. Absence of both antigen A and antigen B is typed as blood group O and presence both A and B antigens is classified as blood type AB. Patient with O type blood is called a universal donor and AB type blood is universal recipient. It is to be noted that, clinical significance of the ABO system is not just restricted to immunohematology, transfusion, and transplantation medicine [3].

*Correspondence
Dr. Sahadevan Vijay
Associate Professor, Department of Radiology, Vinayaka Mission's Medical College and Hospital, Karaikal, India.
E-mail: zephyrs87@yahoo.co.in

Recent scientific literature of supports the importance of the ABO blood group system in the development of cardiovascular, infectious, and neoplastic diseases, as well as in several other human disorders. ABO blood type has important implications on the development of cancer when there are alterations in the glycoconjugates on the surface of RBC leading to changes in intracellular adhesion, molecular signaling and immunosurveillance [4]. Aird et al in 1953 found out the significant association of ABO blood group with development of gastric cancer [5]. Following which many well designed clinical trials have been reported with a recent cohort study from USA, proving the association of blood type O and the significant association with pancreatic cancer [6]. Also, a recent cohort study from shanghai highlights variation in risk of carcinoma and adenocarcinoma by different ABO blood types. Shanghai cohortstudy showed the reduced incidence of gastric cancer and bladder cancer in type B compared to other types, while those with blood type AB were at increased risk of liver cancer [7]. Considering the fact very less data is available on this topic of ABO blood group and the risk of cancer all over the globe and predominantly very minimal prospective cohort studies in Asian population, we decide to do our study. Aim of our study is to find out the association of ABO blood type with different type of cancer based on site and histology.

Materials and methods

Study design

Retro-Prospective Hospital Based Study

Study duration

1 year after obtaining ethical clearance

Study setting & study population

Department of Radiology, Vinayaka Mission's Medical College and Hospital,

Sampling technique
Consecutive Sampling
Inclusion criteria
Patients above 18 years of age
Patients giving Consent
Patients referred to CECT with clinical diagnosis of suspected carcinoma
Only ABO blood group patients
Exclusion criteria
Patients with diagnosis as carcinoma and taken for surgical procedure
Follow up cases after surgery coming for follow up CT
Non- ABO blood type
Data collection tool
Retrospective data was collected from MRD and Prospective data was collected directly from patient case sheet and data was collected whenever a new patient came to radiology department for CECT
Study procedure
Ethical approval was obtained, Patients diagnosed of carcinoma coming to CECT was included and those with previous history of surgery done for carcinoma, follow up cases coming for CT scans were excluded. All the data was collected in separately designed excel sheet and later statistical analysis was performed.
Ethical considerations
Data collection was started only after getting ethical clearance, Privacy of the patient & confidentiality of clinical data was maintained throughout the study. Informed written consent was taken prior to inclusion in study. The study was done without any additional expense to the patient. All the included investigation was routinely done for the treatment of their disease & additional expenses if any was met by the investigator
Statistical Analysis
Data was entered in Microsoft EXCEL work sheet. Analysis was done using RStudio version 1.1.683, statistical software for windows. Qualitative variables were expressed in frequencies and proportions. Quantitative variables were expressed as mean and standard deviation. To study the association between cancer site and histological types with ABO blood group fisher test was used and data was analyzed.

Results

Table 1: Baseline and demographic characteristics of patients

Demography	A(n=124)	B(n=154)	AB(n=58)	O(n=165)	p value
Age Years - Mean (SD)	53.3 (12.02)	50.5 (11.87)	48.7 (12.51)	52.7 (13.28)	0.0485
Height in cm's - Mean (SD)	160.4 (20.72)	160.9 (8.47)	160.4 (10.41)	160.8 (8.87)	0.9896
Weight in Kg's - Mean (SD)	60.2 (12.66)	61.8 (12.97)	61.3 (14.14)	59.7 (12.87)	0.4794
BMI Kg/m2 – Mean (SD)	23.0 (4.14)	24.1 (4.52)	23.6 (4.06)	23.1 (4.40)	0.1065
Smoking Status, n (%)					
Never Smoker	107 (86.29%)	130 (84.42%)	49 (84.48%)	133 (80.61%)	0.8216
Former Smoker	11 (8.87%)	13 (8.44%)	4 (6.90%)	19 (11.52%)	
Current Smoker	6 (4.84%)	11 (7.14%)	5 (8.62%)	13 (7.88%)	
Alcohol Drinking Status, n (%)					
Non-Drinker	110 (88.71%)	134 (87.01%)	51 (87.93%)	143 (86.67%)	0.9582
Drinker	14 (11.29%)	20 (12.99%)	7 (12.07%)	22 (13.33%)	
H. pylori antibody serologic status, n (%)					
Positive	0 (0%)	3 (1.95%)	2 (3.45%)	2 (1.21%)	0.3772
Negative	4 (3.22%)	4 (2.60%)	2 (3.45%)	6 (3.63%)	
HBsAg serologic status, n (%)					
Positive	0 (0%)	4 (2.60%)	0 (0%)	3 (1.82%)	0.3747
Negative	124 (100%)	150 (97.40%)	58 (100%)	161 (97.58%)	

Table 2: Association between cancer site and abo blood group

Cancer site	A(n=124)	AB(n=58)	B(n=154)	O(n=165)	TOTAL(n)	%
Esophagus	6 (4.84%)	2 (3.45%)	7 (4.55%)	5 (3.03%)	20	4.0
Stomach	16 (12.90%)	6 (10.3%)	10 (6.4%)	23 (14%)	55	11.0
Small Bowel	0	0	6 (3.90%)	2 (1.21%)	8	1.6
Colorectum	29 (23.39%)	14(24.1%)	31(20.1%)	34(20.6%)	108	21.6
Liver	1 (0.81%)	1 (1.72%)	4 (2.60%)	5 (3.03%)	11	2.2
GB	5 (4.03%)	5 (8.62%)	14 (9.09%)	11 (6.6%)	35	7.0
Pancreas	7 (5.65%)	3 (5.17%)	10 (6.49%)	12 (7.2%)	32	6.4
Kidney	6 (4.84%)	0	12 (7.79%)	7 (4.24%)	25	5.01
Lung and Trachea	15 (12.10%)	1 (1.72%)	13 (8.44%)	22 (13%)	51	10.2
Prostate	4 (3.23%)	2 (3.45%)	5 (3.25%)	9 (5.45%)	20	4.0
Cervix	5 (4.03%)	4 (6.90%)	17 (11.04%)	13 (7.88%)	39	7.8
Ovary	13 (10.48%)	10 (17.24%)	11 (7.14%)	9 (5.45%)	43	8.6
Endometrium	3 (2.42%)	2 (3.45%)	3 (1.95%)	4 (2.42%)	12	2.4
Urinary Bladder	7 (5.65%)	4 (6.90%)	4 (2.60%)	3 (1.82%)	18	3.6
Testis	2 (1.61%)	1 (1.72%)	1 (0.65%)	1 (0.61%)	5	1.0
Lymphoma Myeloma Leukemia	4 (3.23%)	2 (3.45%)	5 (3.25%)	5 (3.03%)	16	3.2
others/Unspecified	1 (0.81%)	1 (1.72%)	1 (0.65%)	0	3	0.6

Since approximately 50% of the cells had expected frequency less than 5, Fisher's exact test was performed to test for the association between ABO Blood type and cancer site, the corresponding p value was 0.1314, which implies, there is no statistically significant association between blood type and cancer site.

Table 3: Association between type of cancer and blood group

Histological type	A(n=124)	AB(n=58)	B(n=154)	O(n=165)	Total cases (n)	(%)
Carcinoma	11 (8.9%)	3 (5.17%)	19 (12.3%)	12 (7.27%)	45	8.9
Adenocarcinoma	58 (46.7%)	27 (46.5%)	80 (51.9%)	109(66.06%)	274	54.9
Sarcoma	0	1 (1.72%)	1 (0.65%)	0	2	0.4
Myeloma Lymphoma Leukemia	5 (4.03%)	2 (3.45%)	5 (3.25%)	6 (3.64%)	18	3.5
Squamous Cell CA	14 (11.2%)	7 (12.07%)	25 (16.2%)	16 (9.70%)	62	12.3
Cystadenocarcinoma	0	2 (3.45%)	1 (0.65%)	3 (1.82%)	6	1.2
Colloid Ca	0	0	0	1 (0.61%)	1	0.2
Urothelial Papillary	7 (5.65%)	4 (6.90%)	4 (2.60%)	2 (1.21%)	17	3.4
Embryonal CA	1 (0.81%)	1 (1.72%)	0	0	2	0.4
Serous CA	9 (7.26%)	5 (8.62%)	5 (3.25%)	5 (3.03%)	24	4.7
Endometroid Carcinoma	5 (4.03%)	1 (1.72%)	5 (3.25%)	3 (1.82%)	14	2.8
Others/Unspecified	9 (7.26%)	4 (6.90%)	6 (3.90%)	3 (1.82%)	22	4.3
Yolk Sac Tumor	0	1 (1.72%)	1 (0.65%)	1 (0.61%)	3	0.5
Non -Small Cell CA	4 (3.23%)	0	0	2 (1.21%)	6	1.1
Small Cell CA	1 (0.81%)	0	2 (1.30%)	2 (1.21%)	5	0.9

Since 63% of the cells had expected frequency less than 5, Fisher's exact test was performed to test for the association between ABO Blood type and type of cancer, the corresponding p value was 0.085, which implies, there is no statistically significant association between blood type and cancer type.

Discussion

In our study total no of participants were 501 patients who met the inclusion criteria. Out of the participants after blood group typing, 124 (24.5%) belonged to A type, 154 (30.5%) were B type, 58 (11.5%) were AB type and the remaining 165 (33%) had O type. The distributions of age, body mass index, height, weight, smoking status alcohol intake were comparable across different ABO blood type. Serological analysis of Pylori and Hep B was also comparable across different ABO blood type. All participants were having normal BMI, and none had BMI greater than 25. Among the study participants 419 were nonsmokers, 47 were former smokers and rest 35 were current smokers. With respect to alcohol intake, 448 participants were non-drinkers and rest 53 were alcoholics [TABLE 1]. The distribution pattern of blood types among participants were comparable to Shanghai cohort study, in which 32% were blood type O, 31% type A, 27% type B, and 10% type AB. The distributions of age, body mass index, height, weight, smoking status alcohol intake were comparable across different ABO blood type even in the Shanghai cohort study [7].The cancer of digestive system was the most frequent diagnosis that accounted for 54% of total cancer cases, followed by genitourinary system (32%) and respiratory system (10%), Lymphoma, leukemia and sarcoma combined accounted for 3% of total malignancies. The remaining malignancies belonged to other or unspecified sites. By individual sites, cancer of the colorectal was the most common cancer diagnosis (accounting for 22% of total cancers), followed by stomach (10%), ovary (9%) and cervix (8%). This was slightly different from cohort study done in Asian population which report lungs (24%) to be the most common site followed by colorectum (16%) and stomach (14%) [TABLE 2]Among the total cancer patients 24.5% belonged to blood group A, 11.5% blood group AB, 30.5% belonged to blood group B, and the remaining 33% blood group O. Among 124 patients having cancer in blood group A, 23.3 % had colorectal cancer, followed by stomach (13%), lung and trachea (12%), and ovary (10.5%). The remaining 41% had cancer in other sites. Among 58 patients having cancer in blood group AB, 24% had colorectal cancer, followed by the ovary (17%) and stomach (10%). The remaining 49% had cancer in other sites. Among 154 patients having cancer in blood group B, 20% had colorectal cancer, followed by the cervix (11%) and gall bladder (9%). The remaining 60% had cancer in other sites. Among 165 patients having cancer in blood group O, 20% had colorectal cancer, followed by stomach (14%) and lung and trachea (14%). The remaining 52% had cancer in other sites. The association of stomach cancer was almost similar in Type O and Type A groups [TABLE 2]

These results were slightly different compared to Chinese Asian study with respect to genitourinary system cancers (13%) and respiratory system (26%) but similar with respect to cancer of digestive system (51%) and it account for majority of cancers [7].The mechanism and reason for this is not clearly understood but however the theory that can be attributed is the increased affinity of Helicobacter Pylori to Lewis antigen expressed by type A and Type O compared to Type B and Type AB which lacks it. Increased Helicobacter Pylori leads to increased gastric mucosal changes and chronic inflammation leading to dysplasia, carcinomas, and metaplasia [8].The results for colorectal cancer were like previous literature with respect to blood type A which was the highest blood type reported with colorectal cancer worldwide. But in our study the association of colorectal cancer was similar across all the ABO blood types making it slightly different from western population and other Asian population like China and Taiwan [9,10]. These results are consistent with the fact that besides erythrocytes, the ABO blood type antigens are also expressed in epithelial cells of gastrointestinal tract and suggesting a role of ABO blood type in the development of epithelial cancers in the gastrointestinal tracts.The cancers of GB, pancreas accounted for 7% and 6% each respectively, cancers of esophagus, prostate and kidney account for 4% each and the results were consistent with previous literature on Asian population [7]. By histology, adenocarcinoma accounted for 54.5% of total histologically confirmed cancer cases while squamous cell carcinoma and carcinomas accounted for 12% and9% respectively. The remaining 24% of cancer cases consisted of cases with other histology types[TABLE 3].With respect to histological type, among 124 patients having cancer in blood group A, 46.7% had adenocarcinoma and 11% had squamous cell carcinoma. The remaining 42% belonged to different histological types. Among 58 patients having cancer in blood group AB, 46.5% had adenocarcinoma and 12% had squamous cell carcinoma. The remaining 41% belonged to different histological types. Among 154 patients having cancer in blood group B, 52% had adenocarcinoma and 16% had squamous cell carcinoma. The remaining 32% belonged to different histological types. Among 165 patients having cancer in blood group O, 66% had adenocarcinoma and 9% had squamous cell carcinoma. The remaining 25% belonged to different histological types [TABLE 3]. This was also different compared to Asian cohort study which reported carcinoma including sarcoma, lymphoma, and leukemia (to have highest occurrence rates (60%) with ABO blood types followed by epidermoid carcinomas (25%) and adenocarcinomas (6%). The incidence of adenocarcinoma was found to be very low in type B and type AB in western and Asian population

in contradictory to our study which reported adenocarcinoma to be predominant histological types across all ABO blood types [7].

Conclusion

Present study demonstrates the association of cancers with respect to sites and histology pattern with different ABO blood types in south Indian population. The results were different from those observed in western and Asian population. So, further cross section/ cohort studies are warranted across Pan India to know the association and variation in risk of cancer types with ABO blood group.

Limitation

Small sample size and no follow up was done to analyze the risk using hazard ratio among the groups.

Abbreviations

RBC – Red Blood Cells
CECT- Contrast-Enhanced Computed Tomography
CT- Computed Tomography

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Author contribution

Paper drafting by Siddharth and corrections by Sahadevan, protocol was developed by both.

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Conflict of Interest: Nil

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