



Association of ABO and Rhesus Blood Group with Type-2 Diabetes Mellitus in Northern India: A Cross-Sectional Study

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

The phenotypic "ABO" blood groups are inherited antigenic substances which are found on the surface of red blood cells in addition to other tissues. ABO & Rhesus (Rh) blood groups systems besides being most important in blood transfusion also are important in disease susceptibility. The incidence of diabetes mellitus has been increasing and linked with many factors such as genetic, environment, diet, obesity, lack of exercise. The study envisages to further add to the existing knowledge on these factors.

Material and Methods :Patients suffering from Type-2 Diabetes Mellitus (diagnosed by ADA criteria) admitted in medicine ward were selected for the study and enrolled as cases and almost equal no. of non diabetic subjects were taken as controls (after taking informed consent) to compare distribution of ABO blood group. Detailed information about age, gender, BMI, age of onset of diabetes mellitus was noted. The records (clinical examination and investigations done by physician) were screened to find any complications. Determination of ABO and Rh status was done by standard slide method of agglutination.

Results: No statistically significant difference was observed between cases and controls for different blood groups. The same findings were noticed when comparison was made between cases and controls for Rh typing. More than three fourth (76.19 %) cases with blood group B had developed one or the other complication as a sequel of the disease.

Conclusion: Our study didnot show any difference between cases and controls for different blood groups and Rh factor. However statistical significant relationship of complications with B blood group is observed.

Keywords:ABO and Rh blood group, Diabetes mellitus (DM), Type 2 Diabetes, diseases.

Introduction

Diabetes mellitus (DM) is a chronic metabolic endocrine disorder and encompass significant morbidity and mortality.¹The total number of people with DM is projected to be 366 million in 2030.² Diabetes mellitus is a multifactorial trait. The aetiology of diabetes mellitus is complex and appears to involve interactions of genetic, immunological and environmental factors. The major human blood group system is ABO and the frequency of specific types varies markedly in different races, ethnic groups, and socioeconomic groups in different parts of the

world.³ Since their discovery by Karl Landsteiner in 1900⁴, many researchers have made attempts to determine the significance of particular ABO phenotype for susceptibility to disease.⁵ Certain diseases show a strong association with the ABO blood groups, notably peptic ulcer & is much higher in blood group 'O'⁶ where as cancer of Stomach⁷, tumours of salivary glands⁸ are more frequent in blood group 'A' individuals. Recently, the relationship between ABO blood groups and disease susceptibility especially DM has generated a lot of interest.⁹ The data on association between the distribution of the ABO blood types and DM is scanty & conflicting, some studies reporting no association and others showed positive association of "ABO" & "Rhesus" blood groups with type 2 diabetes. The study aimed to find/ investigate potential association between the two.

Aims and objectives

1. To study the association of different blood groups with Type 2 Diabetes Mellitus.
2. To find any association of different blood groups with presence of complications of Type 2 Diabetes Mellitus.

Material & Methods

A total of 622 subjects were included in the present study conducted from January to October 2017 in hospital settings of a tertiary hospital. All the already diagnosed patients of Diabetes Mellitus who were admitted in medicine wards of a medical college hospital during the study period and gave an informed written consent were included in the study. For comparison purpose, equal numbers of apparently healthy subjects were randomly selected from among the hospital staff and attendants of the patients admitted in medicine ward of the institution. The controls so selected were matched with cases for sex (male and female) and ages (with SD of ± 2 years). The

study had received approval from Institutional Ethical Committee of the college.

Inclusion criteria: Age more than 30 years, had given written consent, already diagnosed case of diabetes (according to the American Diabetes Association venous blood glucose values higher than or equal to 7mmol/l ≥ 126 mg/dl), admitted in hospital for some ailment and having DM type 2.

Exclusion criteria: Subjects with T1DM or diabetes due to metabolic disease, drug induced, past history of pancreas surgery were excluded from the study.

The study subjects were interviewed so as to ensure privacy and all the information collected was incorporated on a pretested, predesigned semi structured questionnaire prepared for the study purpose. Information about Socio demographic characteristics was collected from all the subjects in the study. Height and weight was noted for all the participants. BMI was calculated.

Body Mass Index: Weight in kg and height in cms were measured using standard methodology as per WHO guidelines. Body mass index (Quetelet index) was calculated using formula $BMI = Wt (kg)/Ht (m^2)^{10}$

Patients of DM were further interviewed for age of diagnosis of disease, family history of diabetes. We also reviewed the records in detail and checked for presence of any complications. The three main complications that were frequently observed were Diabetic nephropathy, peripheral neuropathy and retinopathy. Cases had already been screened for complications (by clinical examination done in other appropriate tests advocated by physician according to different guidelines by ADA¹¹)

For Diabetic Nephropathy: Diagnosis is based on measurement of urinary albumin excretion (as defined by ADA); albuminuria 30-299mg/24h and albuminuria >300 mg/24h.

Peripheral Neuropathy: Assessment should include a careful history and either temperature or pin prick sensation and vibration sensation using a 128 –Hz tuning fork (large fibre fn), light touch perception using a 10-g monofilament and ankle reflexes.

Retinopathy: Ocular examination mainly by ophthalmoscope (by using International classification of Diabetic Retinopathy as defined by ADA) and few other tests done in some cases.

ABO Blood Grouping and Rh Typing: The ABO blood grouping and Rh typing were performed in the clinical laboratory, by the standard slide method of agglutination by using a commercial kit of Antiserums A, B, and D (Tulip Diagnostics P Ltd) for all the study subjects (cases) and controls.

Statistical Analysis

The data obtained were analyzed using statistical software open epi info version 6.0. Data were expressed as frequency and percent. Statistical tests like Chi-square test(for qualitative data) and ANOVAs (for quantitative data)were applied to compare the blood groups with regards to different variables. $P < 0.05$ was considered to be statistically significant.

Results

A total of 622 subjects were studied of which 308(49.51%) were males and 314(50.48%) were females. There were 310 cases and 312 controls that were included in the study. Table 1 shows that B blood group was the commonest among males, females and the study subjects as a whole (39.61%, 37.57% & 38.58% resp). AB blood group was least common in males(9.74%), females(8.91%) & the study population combined(9.32%). For Rhesus factor, positive was observed in maximum subjects although 6.49% males, 4.45% females and 5.46% combined group also showed negative in Rh typing. Table 2 depicts 58.88 % of controls as compared to 41.11% of

cases had A as blood group. For blood groups B & AB the cases (52.5% & 51.72%) were a little more than controls (47.5% & 48.27%). Distribution of cases and controls was equal for Blood group O. No statistically significant difference was seen between cases and controls for different blood groups. The same findings were observed when comparison was made between cases and controls for Rh typing. Among cases, when different blood groups were compared for presence or absence of complications, a statistically significant difference ($P = 0.00$) was observed in cases with blood group B. More than three fourth (76.19 %) cases with blood group B had developed one or the other complication as a sequel of the disease. There was no statistically significant difference in presence or absence of complications for cases of blood groups A, AB & O ($P = 0.08, 0.56$ & 0.06 resp) (Table 3). Table 4 shows that on conducting Anova test, it was observed that cases with different blood groups were comparable for variables like mean age, height, weight, BMI, and age of onset of disease. The p value did not show any statically significant difference.

Discussion

Diabetes Mellitus (DM) is recognized as a global major public health problem and is one of the main contributors to ill health and premature mortality & morbidity worldwide.¹² DM is a syndrome characterised by sustained elevation of plasma glucose levels, type 1 diabetes is an autoimmune disease, while type 2 diabetes typically results when insulin secretion from the islets fail to keep pace with increasing insensitivity to the action of circulating insulin on its target tissue (particularly muscle, liver and fat). It was reported that DM type 2 is the most common type, accounting for 90-95 % of all diabetic cases.¹³ Our study is confined to T2DM subjects. The development of T2DM has a strong genetic component. The development is the result of interaction between

environmental factors and a strong hereditary component. The genes that predispose are incompletely identified, but recent genome wide association studies have identified few genetic loci that underlie this hereditary component. While genetic susceptibility to T2DM is under active investigation blood group as a genetic trait with easy access can help in this field.¹⁴

Studies have been conducted in different countries regarding the susceptible of blood group as risk factor for DM in different population.¹⁵ The results have been proved as inconsistent and differed from one county to other. Many researchers have recognized a relationship between blood groups and diabetes even though in some studies no relationship could be established.^{16,17-18} The purpose of the study was to find out the association between different ABO blood groups and diabetes mellitus and association if any of ABO blood group with complications in Type-2DM or not. Results of this study showed no significant association between blood groups and diabetes mellitus. Among ABO blood groups, significant association was observed in our study in distribution of complications among cases (Type2 DM) with B blood group. It is interesting to note that our study did show a higher percentage of blood group B in the diabetic group, but failed to show any statistical significance. The study demonstrated that, in both the diabetics and nondiabetic subjects, blood group B has the highest frequency followed by A, O and AB. Gender based distribution of overall study subjects (cases and controls) also suggest same frequency order. The study is in agreement with kapoor C et al.¹⁹ Similarly RahmanM²⁰ reported 'no such association in his study conducted on diabetic subjects for ABO blood group. Macafee,²¹ Koley²² et al also reported that there was no significant association between ABO blood group and diabetes mellitus. On the contrary previous studies on the relationship of ABO blood group

and DM have reported different results. Qureshi and Bhatti²³ suggested blood group B as a risk factor for T2DM. Raheja²⁴ et al found significant preponderance of group O among diabetic patients. The review study published in 2016 by Meo et al reported B blood group has the most relationship and O blood group has the least relationship with T2DM.²⁵ The increased frequency of blood group A among diabetics has been reported by Pramanik T et al.²⁶ The association between ABO blood groups and diabetes mellitus is still unclear despite many studies referring to the topic. No study has convincingly explained the mechanism by which A or B antigens could modify the risk of DM. The possible explanation of these conflicting findings suggests that racial and environmental factors have a role in genetic expression of disease. They do not impact everyone in the same way. Even with the same environmental exposures, some people are more susceptible to developing diabetes than others, and this increased risk appears to be inherited. Large sample size multicentric studies are needed for better analysis of association between ABO and Rh blood groups with T2DM risk.

List of Tables

Table 1–Sexwise distribution of different blood groups and Rhesus factor in the study subjects.

Blood groups	No. of No of subjects n=622	% of subjects	No. of Males N=308	% of Males	No. of Females N=314	% of Females
A	180	28.93	86	27.92	94	29.93
B	240	38.58	122	39.61	118	37.57
AB	58	9.32	30	9.74	28	8.91
O	144	23.15	70	22.72	74	23.56
Rh ⁺	588	94.53	288	93.50	300	95.54
Rh ⁻	34	5.46	20	6.49	14	4.45

Table 2- Comparison of cases and controls for different blood groups and Rhesus factor.

Blood Groups	Cases n=312		Controls n=310		Total	X ²	P
	No	%	No	%	No (%)		
A	84	41.11	96	58.88	180(100)	1.23	0.26
B	126	52.5	114	47.5	240(100)	0.85	0.35
AB	30	51.72	28	48.27	58(100)	0.06	0.80
O	72	50.0	72	50.0	144(100)	0.00	0.96
Rh ⁺	290	49.31	298	50.68	588(100)	3.04	0.08
Rh ⁻	22	35.29	12	64.70	34(100)	3.04	0.08

Table 3- Distribution of complication in different blood groups among cases (Pearson's chi square)

Blood group	complication		Total No (%)	X ²	p
	Present(202) No (%)	Absent(110) No (%)			
A	48 (57.14)	36(42.85)	84(100)	2.90	0.08
B	96(76.19)	30(28.57)	126(100)	12.13	0.00*
AB	18(60.00)	12(40.00)	30(100)	0.32	0.56
O	40(55.55)	32(44.44)	72(100)	3.46	0.06

Table 4-Distribution of different variables in different blood groups among cases (Anova)

	A	B	AB	O		
Age	63.51± 10.47	61.82±10.22	63.40±7.77	59.97±12.97	0.75	0.52
ht	1.64±.07	1.64±.08	1.67±.07	1.64±.07	0.72	0.53
wt	65.18± 8.53	66.82± 8.74	70.60± 11.62	66.61± 6.51	1.43	0.23
BMI	24.86±6.20	24.82±3.46	25.15±3.80	24.61±2.84	0.06	0.98
Onset	54.21 ±10.93	53.84±9.39	53.26±6.90	51.72±12.12	0.43	0.72

Acknowledgment: Authors would like to thank all the participants for their kind cooperation in conducting the study and all those who directly or indirectly were helpful in the study.

Funding: No Funding sources

Ethical Approval: The study was approved by the Institutional Ethics Committee

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