Original article

A Cross Sectional Study on the Prevalence of ABO and Rh Positive Blood Groups among the Male Type 2 Diabetes Mellitus Patients in Greater Guwahati

Heemanshu Shekhar Gogoi *

Post Graduate Trainee, Department of Physiology, Gauhati Medical College, Guwahati, Assam.
Corresponding author*

Abstract

Introduction: Diabetes Mellitus is a clinical syndrome characterized by hyperglycaemia due to absolute or relative deficiency of insulin. A blood group system consists of a group of antigens encoded by alleles at a single gene locus or at gene loci so closely linked that crossing over does not occur or is very rare. The finding of disease-blood group associations emphasizes the fact that there may be significant physiological differences between individuals of different blood types.

Aim: This study was done to evaluate the prevalence of ABO and Rh positive blood groups among the male type 2 diabetes mellitus patients in greater Guwahati.

Method: It was a population-based study done in greater Guwahati. 500 male type 2 diabetes mellitus subjects were selected according to inclusion and exclusion criterias. Their blood groups were determined using slide haemagglutination technique. Their random blood glucose levels of the subjects were also estimated.

Results: It was found that he prevalence of 'B' Rh positive blood group among male type 2 diabetics was 41%. Similarly, 38% subjects belonged to 'O' Rh positive, 14% subjects belonged to 'A' Rh positive and lastly, 7% subjects belonged to 'AB' Rh positive blood group.

Conclusion: The study suggests that 'B' Rh positive and'O' Rh positive blood groups are more prevalent ones than that of the 'A' Rh positive and 'AB' Rh positive blood groups among the male type 2 diabetes mellitus patients in greater Guwahati.

Key words: Diabetes mellitus, blood group, slide haemagglutination technique.

Introduction

American Diabetes Association has defined diabetes mellitus as a group of metabolic diseases characterized by elevated levels of glucose in the blood resulting from defects of insulin secretion, insulin action or both. Thus, Diabetes Mellitus is a clinical syndrome characterized by hyperglycaemia due to absolute or relative deficiency of insulin. Several distinct types of diabetes mellitus are caused by a complex interaction of genetics and environmental factors.[1] Diabetes mellitus is generally divided as insulin-dependent diabetes mellitus (IDDM or type I), characterized by the body's failure to produce insulin and requires the person to inject insulin and non-insulin-dependent diabetes mellitus (NIDDM or type 2), characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency.[2] Type 2 diabetes mellitus is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production. Distinct genetic and metabolic

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

defects in insulin action and/or secretion give rise to the common phenotype of hyperglycemia in type 2 diabetes mellitus and have important potential therapeutic implications now that pharmacologic agents are available to target specific metabolic derangements.[1]

The number of people with diabetes mellitus in India currently around 40.9 million is expected to rise to 69.9 million by 2025.[3] The worldwide prevalence of diabetes mellitus has risen dramatically over the past two decades, from an estimated 30 million cases in 1985 to 382 million in 2013. Based on current trends, the International Diabetes Federation projects that 592 million individuals will have diabetes by the year 2035. The countries with the greatest number of individuals with diabetes in 2013 are China (98.4 million), India (65.1 million), United States (24.4 million), Brazil (11.9 million), and the Russian Federation (10.9 million).[4]

Criteria for the Diagnosis of Diabetes Mellitus
• Symptoms of diabetes plus random blood glucose concentration ≥11.1 mmol/L (200 mg/dL) *or* • Fasting plasma glucose ≥7.0 mmol/L (126 mg/dL) *or* • A1C > 6.5% *or* • Two-hour plasma glucose ≥11.1 mmol/L (200 mg/dL) during an oral glucose tolerance test.

(*Source: American Diabetes Association, 2011*).

A blood group system consists of a group of antigens encoded by alleles at a single gene locus or at gene loci so closely linked that crossing over does not occur or is very rare. An antigen collection consists of antigens that are phenotypically, biochemically, or genetically related, but the genes encoding them have not been identified.[5] The chief blood groups are classical ABO blood groups and Rh blood groups. Discovery of the ABO system by Landsteiner in 1901 marked the beginning of safe blood transfusion. In ABO blood group system the four groups are determined by presence or absence of antigen A(α) and/or antigen B (β) on the red blood cells, and therefore, an individual is either group A, B, AB or O (O denoting the absence of antigen A and antigen B).[6,7] The Rh (not Rhesus) system is the second most important blood group system in transfusion medicine because antigen-positive RBC's frequently immunise antigen-negative individuals through transfusion and pregnancy. Individuals are grouped as either Rh 'positive' or Rh 'negative' based upon the presence or absence of the major D antigen on the surface of their red blood cells.

Several researchers suggested evolutionary significance of AB antigen because the frequencies of different ABO blood group types vary across different populations, suggesting that a particular blood type confers a selection advantage (for example, protection against an infectious disease).[8,9] It is possible that it is not the presence of a given

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

blood type but rather the absence of the protective effect of other alleles that is responsible for disease development.

Aims and objectives

To evaluate the prevalence of ABO and Rh positive blood groups among the male type 2 diabetes mellitus patients in greater Guwahati.

Materials and methods

The study was performed during the period from 1st of September, 2015 to 31st of July, 2016 for a duration of eleven months.

Written and informed consent was obtained from the subjects before initiating the study.

Selection of subjects

Research design: - Community based cross sectional study.

Study area: - Greater Guwahati (Near the Bhangagarh area which is one of the central zones of Guwahati city and the patients who came to Gauhati Medical College and Hospital from any of the regions of greater Guwahati area).

Study population: - Community dwelling male population of age group 40 to 65 years.

Sampling procedure : - Purposive sampling.

Sample size : - 500 number of male type 2 diabetes mellitus patients.

Inclusion criteria

1. All ABO Rh positive blood group male subjects were selected.
2. Only type 2 diabetes mellitus patients on hypoglycaemic treatment were selected.
3. Age group – 40 to 65 years.
4. No family history of hypertension, diabetes mellitus or other co-morbidities.
5. Non-vegetarian males with a history of type 2 diabetes mellitus for more than two years.

Exclusion criteria

1. All ABO Rh negative blood group male subjects.
2. All females.
3. Patients affected by cardio-vascular diseases or liver, respiratory, kidney or endocrinal disorders (other than diabetes mellitus), haematological disorders and/or neoplasms.
4. Use of medications other than hypoglycaemic drugs.

Subjects were tested for the following tests.

Determination of blood groups

Blood group was determined using slide haemagglutination technique. A small quantity (about 1cc) of 1% sodium citrate solution in normal saline was taken in a watch glass. A free flowing sample of blood was obtained by pricking the finger with usual aseptic and antiseptic precautions. A few drops (nearly 4 to 5 drops) of blood were dropped into the watch glass containing the citrate solution. The blood was mixed thoroughly with the citrate solution. A clean glass slide wastaken. A drop of citrate solution was placed on one end of the slide and on the other end was placed a drop of anti-A serum with the help of a labelled dropper. This slide was labelled as anti-A by a glass marking pencil. Similarly a drop of citrate solution and a drop of anti-B serum were taken at the two ends of another slide. This slide was labelled as anti-B. A drop of blood diluted with citrate solution was now added to each of these drops and was mixed with them with separate applicator sticks. After mixing they were left for half an hour for reaction to take place between agglutinin and agglutinogen. At the end of half an hour the slides were examined by naked eye to see if there was any agglutination of red cells in the test samples. If there was any agglutination the red cells appear as isolated

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

coarse clumps of brick red colours due to hemolysis of red cells and liberation of haemoglobin as a result of agglutination.

Interpretation of result by slide haemagglutination technique.

Reagents		Interpretation
Anti-A	Anti-B	Group
+	–	A
–	+	B
+	+	AB
–	–	O

Key: '+' = Agglutination, '–' = No agglutination.

In the same way Rh-grouping of the blood can be done by using serum containing anti-Rh (usually anti-D) agglutinin.

Estimation of random blood glucose concentration

Under all aseptic and antiseptic measures, random blood glucose estimation was done using glucometer (OneTouch SelectSimple blood glucose monitoring system, LifeScan Europe, Division of Cilag GmbH International, 6300 Zug, Switzerland).

Results

In this study the following results were found 205 patients out of 500 type 2 diabetes mellitus patients belonged to 'B' Rh positive blood group, so the prevalence of blood group 'B' Rh positive among the type 2 diabetes mellitus patients is found to be 41%. 190 patients out of 500 type 2 diabetes mellitus patients belonged to 'O' Rh positive blood group, so its prevalence is 38%. 70 patients out of 500 type 2 diabetes mellitus patients belonged to 'A' Rh positive blood group, so its prevalence is 14%. 35 patients out of 500 type 2 diabetes mellitus patients belonged to 'AB' Rh positive blood group, so its prevalence is 7% (see table-1 and fig-1).

Table-1: This table shows the percentage of prevalence of ABO and Rh positive blood groups in male type 2 diabetes mellitus patients.

S. No.	Blood group (ABO-Rh positive)	No. of subjects out of 500 subjects	Percentage (%) of prevalence
1.	'B'	205	41
2.	'O'	190	38
3.	'A'	70	14
4.	'AB'	35	7

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

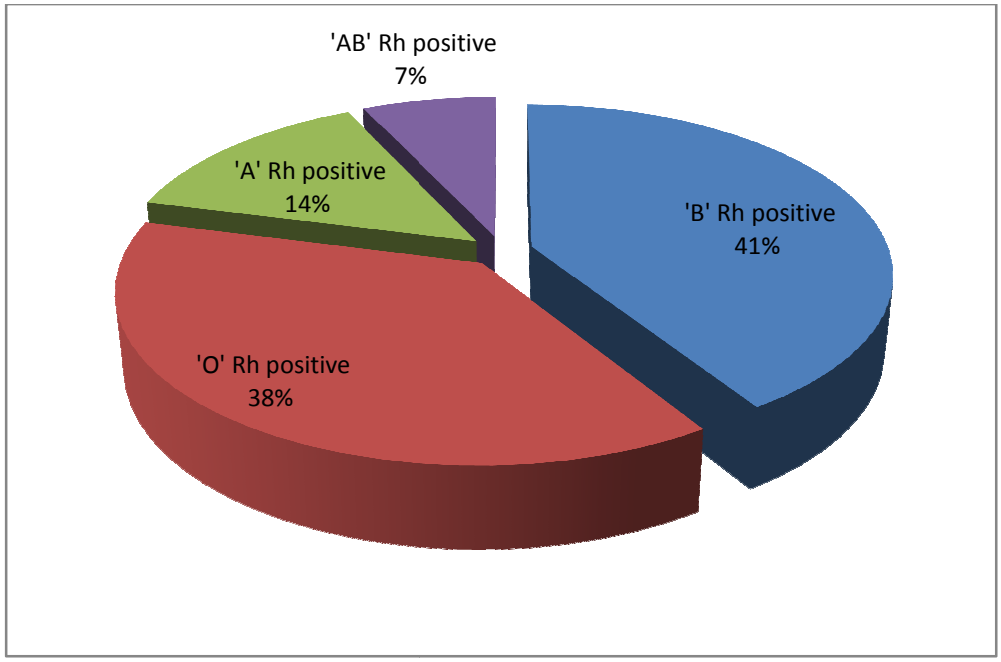

Fig-1: This figure shows the percentage of prevalence of ABO and Rh positive blood groups in male type 2 diabetes mellitus patients.

Discussion

There is some evidence that ABO blood groups may be associated with certain diseases. Gastric cancer has been reported to be more prevalent in individuals with blood group A, peptic ulcer is more often in there with group O.[10] One of the best established blood group associations is that between blood type O of the ABO system and duodenal ulceration,[11] although even this has not been confirmed in every investigation.[12] As ischaemic heart disease has a strong association with duodenal ulcer, and as duodenal ulcer has a strong association with blood group O, one would expect to find an excess of O's among ischaemic heart disease patients.[13] There is a previously reported evidence for genetic mediation of components of the blood pressure control system.[14] Blood group O is the most common group in India as evident from various studies. More than 60% of the population in India has blood group A and O. The least common group is AB blood group. In USA, England, Africa, Australia and Saudi Arabia majority of the people have blood A and O. Sex distribution had no significant association with the blood group. The recent studies have also shown similar results. Although numerous studies have revealed genetic influences on physiological mediators been defined and genetic markers have not been identified.[15]

The importance of the gene-environment interaction in disease development is unknown, but it may be responsible for the familial aggregation of apparent non genetic disorders. This is confounded by the fact that families share both genes and household environments. It is possible that it is not the presence of a given blood type but rather the absence of the protective effect of other alleles that is responsible for disease development. It is beyond the nature of the current investigation to discriminate between these alternative hypotheses.

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

In Tokyo, Naoto Egawa et al. found that the type 2 diabetes mellitus group had a higher frequency of blood group B.[16] It is similar to the observation of Joseph A. Buckwalter and Henry et al. who analyzed high incidence of group B among diabetic patients which were in contrast with other studies done in Iowa city & Basrah city.[17, 18] Yet another group of scientists found no difference between the different blood group frequencies in diabetic patients. In western Algerian population, 280 patients with type 2 diabetes mellitus and 271 healthy controls studied by Dali Sahi M et al. and they confirmed that there was no association between ABO/Rh blood group and diabetes mellitus.[19]

On the other hand, several investigators observed varying results. Anderson J and Lauritzen E found significant excess of group O among male diabetics. In diabetics female too, there was excess of group O but not significant.[20] Jolly JG and Sarup BM et al. found significant preponderance of group O among diabetic patient.[21] Again W.E. Jassim found significantly higher occurrence of blood group O than other groups in male and female patients in Baghdad, Iraq.[22] Different clinical studies have shown that individuals of the O phenotype blood group are more susceptible to Diabetes mellitus diseases.

But there are conflicting repoprts also. Dr. K Berg et al. did not find an association between diabetes mellitus and the ABO system, as reported in earlier literature.[23] But Bibawi and Khatwa from Egypt found increased incidence of Group A and AB and a correspondingly lower incidence of B and O blood group in diabetes.[24] Rahman M tested 3212 diabetics for ABO blood groups and compared their frequency with normal (8936) subjects. The data were analysed statistically to detect any possibility of an association between ABO blood groups and diabetes mellitus. No such association was apparent in the subjects studied.[25] Kapoor C et al. showed no statistically significant correlation in distribution of blood groups (ABO) and secretor status among diabetics as compared to controls.[26] Lamey PJ studied 55 patients with type I diabetics and 50 with type II diabetes & found no significant difference in distribution of ABO blood groups between those with type I and these with type II disease.[27]

The finding of disease-blood group associations emphasizes the fact that there may be significant physiological differences between individuals of different blood types. They may be of clinical interest and help in understanding the interactions of many of the factors affecting the diseases involved. It is unlikely that there exists any selective advantage, however, most of the diseases involved exhibit their major effects at the end of their productive period.[28]

Conclusion

This study has shown that the blood group ‘B’ Rh positive and ‘O’ Rh positive are more prevalent in type 2 diabetes mellitus patents as compared to ‘A’ Rh positive and ‘AB’ Rh positive blood groups in greater Guwahati.In this study the small sample size was a limitation. There is a prospect of performing a large scale study with ABO and Rh positive as well as ABO and Rh negative blood grouped type 2 diabetes mellitus subjects including both male and female subjects from different parts of the state or the North-Eastern region or the other regions or parts of the country or even internationally as it will give more insight into the relationship between different ABO and Rh positive and negative blood groups with that of hypertension. A further study is needed to evaluate whether blood group is an etiological factor of type 2 diabetes mellitus. For this, equal number of

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

subjects for each blood group is to be taken and then after that from the equal number of subjects from each blood group the number of type 2 diabetes mellitus subjects to be identified. As our study has shown the prevalence of type 2 diabetes mellitus is more in some particular blood groups than in others so by utilizing this knowledge certain precautions can be taken against type 2 diabetes mellitus in the individuals belonging to more type 2 diabetes mellitus susceptible blood groups right from their childhood. Lastly, if we can understand the genetics involving ABO and Rh blood groups and type 2 diabetes then even genetic level anti-type 2 diabetes mellitus interventions may become possible in the near future.

Acknowledgements

I express my deep sense of gratitude to my parents Mr. Horen Gogoi and Mrs. Kiron Gogoi and to all those doctors and the participants of this study without whose support this study might not have been successful. A special thanks to Dr. (Mrs.) Bonti Bora (Professor and Head of the Department of Physiology , Gauhati Medical College) and Dr. (Mrs.) Reeta Baishya (Professor of the Department of Physiology, Gauhati Medical College and Hospital) for their help and support.

References

1. Longo, Fauci, Kasper, Hauser, Jameson, Loscalzo. Harrison's Principles of Internal Medicine. 18th edition. Volume 2. Mc Graw Hill. 2012. Chapter 344: Diabetes Mellitus. pp. 2968-2997.
2. Kumar V, Fausto N, Abbas AK, Cotran RS, Robbins SL; Robbins and Cotran Pathologic Basis of Disease. 7th edition, Philadelphia, Pa.: Saunders. 2005: 1194–1195.
3. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C; Epidemiology of type 2 diabetes Indian scenario. Indian J Med Res., 2007; 125: 217-230.
4. Longo, Fauci, Kasper, Hauser, Jameson, Loscalzo. Harrison's Principles of Internal Medicine. 19th edition. Volume 2. Mc Graw Hill. 2015. Chapter 417: Diabetes Mellitus: Diagnosis, Classification, and Pathophysiology. pp. 2400-2401.
5. Lewis M, Anstee DJ, Bird GWG, et al: Blood group terminology 1990. ISBT working party on terminology for red cell surface antigens. Vox Sang 58:152, 1990.
6. Miller JZ, Grim CE, Connally PM, Weinberger MH. Association of blood groups with essential and secondary hypertension. A possible association of the MNS system. Hypertension, 1971; 1: 493-497 Medicine. "1007, 10th edition. Blackwell Science, oxford, UK.
7. Nance WE, Kreger H, Azeveda E, MIMP. Human blood pressure and the ABO blood group system an apparent association. Hum BIO/. 1965; 37:238-244.
8. Reid ME, Bird GW 1990. Associations between human red cell blood group antigens and disease. Transfusion Medicine Reviews, 4: 47–55.
9. Daniels G 2002 Human Blood Groups. 2nd Edition. Oxford: Blackwell Science.
10. Reid ME, Bird GW 1990. Associations between human red cell blood group antigens and disease. Transfusion Medicine Reviews, 4: 47–55.
11. Clark CA: Blood groups and disease. In Progress in Medical Genetics, Vol 1. Edited by Steinberger AG. NewYork, Gmne and Stratton, 1961, p81.
12. Beaglehole, R., Eyles, E., Salmond, C., PriorI: 1978. Blood pressure in Tokelauan children in two contrasting environments. Am J Epidemiol., 108:283.

13. Allan, T. M. and Audrey, A. Dawson. 1968. ABO blood groups and ischaemic heart disease in men. British Heart Journal., 30, 377.
14. Grim CE, Miller JZ, Luft FC, Christian JC, Weinberger MH: Genetic influences on renin, aldosterone, and the renal excretion of sodium and potassium following volume expansion and contraction in normal man. J Clin Endocrinol Metab. 1980 Feb; 50(2):219-22.
15. Ambareesha Kondam, M. Chandrashekar, M. Suresh, Purushothaman, B.A. Madhuri & Qairunnisa. A study of incidence of hypertension in ABO and rhesus blood group system. International Journal of Biological & Medical Research, 2012; 3(1): 1426-1429.
16. Egawa N, Lin Y, Tabata T, Kuruma S, Hara S, Kubota K et al.; ABO blood type, longstanding diabetes, and the risk of pancreatic cancer. World J Gastroenterol., 2013; 19(16): 2537-2542.
17. Buckwalter JA; diabetes mellitus and the blood groups. Diabetes, 1964; 13:164-168.
18. Henry, Mervyn U, King P, Theodosius MW; Blood groups in diabetes: a preliminary survey in south Trinidad. West Indian Med J; 1961; 10(3):156-160.
19. Dali Sahi M, Aour Metri A, Belmokhtar F, Belmokhtar R Boazza F; The relationship between ABO/rhesus blood groups and type 2 diabetes mellitus in Maghnia, western Algeria. S Afr Fam Pract., 2011; 53(6): 568-572.
20. Andresen J, Lauritzen E; Blood groups and diabetes mellitus. Diabetes, 1960; 9: 20-24.
21. Jolly JG, Sarup BM, Aikat BK; Diabetes mellitus and blood groups. J Indian Med Assoc., 1969; 52(3): 104-107.
22. Jassim WE; Association of ABO blood group in Iraqis with hypercholesterolaemia, hypertension and diabetes mellitus. East Mediterr Health J., 2012; 18(8): 18(8):888891.
23. Berg K, Aarseth S, Lundevall J, Reinskou T; Blood groups and genetic serum types in diabetes mallitus. Diabetologia, 1967; 3(1): 30-34.
24. Bibawi E, Khatwa HA; The blood groups in relation to diabetes. J Egypt Med Assoc., 1961; 44: 655-659.
25. Rahman M; Non-association of ABO blood groups with diabetes mellitus in bangladesh. Bangladesh Med Res Counc Bull., 1976; 2(2):144-146.
26. Kapoor C, Shettar SS; Distribution of Blood Groups among Patients with Diabetes Mellitus and their Secretor Status. Ind J of Pub Health Res & Dev., 2012; 3(1): 66-69.
27. Lamey PJ, Samaranayake LP, MacFarlaneTW; Secretor state of patients with insulin dependent andnon insulin dependent diabetes mellitus. Br Med J (Clin Res Ed), 1987; 295(6612):1563.
28. Cavalli-Sforza LL, Bodmer WF: The Genetics of Human Populations. San Francisco, WH Freeman Co, 1971.

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858