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Study on the interrelationship between ABO and Rh blood groups and common refractive errors in a population of south arcot district of Tamilnadu, India.

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Abstract

Background: ABO and Rh blood typing are the best-known genetic polymorphisms. The genetically determined characters can act as markers for refractive errors of the eye. The aim of the study is to find out the susceptibility of individual to refractive errors in relation to blood typing.

Materials and Methods: This is a population-based, cross-sectional study of 387 unrelated patients. All participants underwent complete ophthalmic evaluation by an ophthalmologist. All the participants ABO and rhesus blood groups were determined.

Results: The participants' ABO blood groups for both the study and control groups shows that 'B' blood group individuals are more in number in study group (52.7%) and 'A' blood group individuals are more in number in control group (28.6%). There is a significant difference (P = 0.000) between control and study ABO blood groups. The participants Rh^{+}ve blood groups are common in both control and study groups. There is no significant difference (P = 0.700) between control and study group. 'B' blood group persons are found to be more affected by refractive errors followed by group 'O', group 'A' and group 'AB'.

Conclusion: It appears that myopia appears in the population at an early stage between 18 – 30 years followed by hypermetropia between 31 – 50 years and presbyopia between 51 – 60 years. Any relation confirmed with blood groups of individuals and their refractive status, can be used as a basis to screen the public earlier for any refractive error and their management.

Keywords: Genetic polymorphisms, Refractory errors, ABO blood grouping, Rh typing,

Introduction

The search for genetic variants that influence the susceptibility of an individual to a chronic disease extends from R.A. Fisher's seminal work, 'quantitative'

inheritance based on mendelian principles in 1918 [1] to the current excitement of whole-genome association studies (WGAS) [2]. The ABO blood group system is the best-known genetic polymorphism in humans. In the century since their discovery, ABO antigen associations with infections and other diseases have been the subject of hundreds of publications [3,4,5,6,7]

Refractive errors (myopia, hyperopia, astigmatism, and presbyopia) affect a large proportion of the population worldwide, irrespective of age, sex and ethnic group [8,9]. Such refractive errors can be easily diagnosed, measured, and corrected with spectacles or other refractive corrections to attain normal vision. If, however, they are not corrected, or the correction is inadequate, refractive errors become a major cause of low vision and even blindness [10]

Visual impairments have immediate and long-term consequences in children and adults, such as lost educational and employment opportunities, lost economic gain for individuals, families and societies, and impaired quality of life. Lack of awareness is the major cause [11]

It has been suggested that the distribution of a number of genetically determined characters may act as markers for refractive errors of the eye. In 1945, E.B. Ford, the British ecological geneticist urged a search for associations between the ABO blood groups and disease [5]. The first such association, described in 1953, was between ABO types and stomach cancer [12]. The role of ABO/Rh blood group as a prognostic factor in breast cancer has been examined and blood group A is often found to be associated with ductal breast cancer (49.6%), in contrast to the other blood groups and particularly to blood group AB (3.6%). Blood group A and, particularly, A (-) has the worst prognosis of all [13].

Using of genetic variants that influence the susceptibility of an individual to a chronic disease could lead to the implementation of much needed preventative screening schemes. Estimation of blood group is a very simple and cost-effective procedure to implement in a large proportion of rural and low-income population [9].

With this idea it was decided to study the relation between blood groups and common refractive errors in patients visiting our outpatient department of Rajah Muthiah Medical College Hospital, Annamalainagar, Chidambaram, Tamilnadu, India.

Materials and methods

This is a population-based, cross-sectional study of 387 unrelated patients attending the outpatient unit of Rajah Muthiah Medical College Hospital, Chidambaram, Cuddalore district, Tamilnadu, India between 2008 and 2010. Written, informed consent was obtained from all subjects, and the study was performed in accordance with the tenets of the Declaration of Helsinki. All participants underwent complete ophthalmic evaluation by a qualified ophthalmologist [13]. All participants ABO and rhesus blood groups were also determined. Documentation of clinical findings included: (a) Gender (b) Age (c) Type of refractive errors like myopia, hyperopia and presbyopia. No specific inclusion and exclusion criteria were followed.

ABO AND RH TYPING: Subject's 5% suspension of red blood cells in normal saline was tested against anti-A antibodies, anti-B antibodies or anti-D antibodies following routine precautions [14].

Determination of visual acuity:

Determination of visual acuity for distant vision

- Visual acuity was measured with Snellen's test types, a series of letters of

- Varying sizes constructed so that the top letter is visible to the normal eye at 60 feet and the subsequent lines at 36, 24, 18, 12, 9, 6 and 5 feet respectively.
- Visual acuity (V) is recorded according to the formula:
- Visual acuity (V) = d / D

Where 'd' is the distance at which the letters are read, and D that at which they should be read.

The patient is normally seated at a distance of 20 feet, i.e., 6 meters.

Determination of visual acuity for near vision

Near vision testing measures your ability to read and see objects close up, within arm's distance from the body. This test is important if you have hyperopia or presbyopia. A near-vision chart usually has test types based on the printer's 'N' series. The smallest is numbered N5 and successive numbers indicate larger types. The usual distance for gauging near reading, till the age of 40 years, is 14 inches. Hold the chart about 35 cm (14") away and notice how far down the chart you can read. If you have perfect near vision you can read the bottom line from arm length and all the way into approx. 15cm from your eyes

Results

The participants of the study were divided into two groups namely study group (with refractive errors) and control group (without refractive errors) [8]. The study group had 216 patients with 119 males and 97 females. The control group had 171 participants with 87 male and 84 females. The participants' ABO blood groups for both the study and control groups are presented in Table 1 and Figure 1. 'B' blood group individuals are more in number in study group (52.7%) and 'A' blood group individuals are more in number in control group (28.6%). There is a significant difference (P = 0.000) between ABO blood groups of both control and study groups. The participants Rh^{+}ve blood groups are common in both control and study groups. There is no significant difference (P = 0.700) between control and study group.

The associations between the ABO blood groups and the type of refractive errors of participants are represented in Table 3 and Figure 3. There is no significant difference between participants' ABO blood groups and type of refractive errors (P = 0.732). The associations between the Rh blood groups and the type of refractive errors of participants are represented in Table 4 and Figure 4. There is no significant difference between participants' Rh blood groups and type of refractive errors (P = 0.980).

Discussion

Garg and Pahwa [15], Deshmukh et al. [16] and Jindal and Bansal [17] first attempted to find association between various eye diseases and dermatoglyphic traits in Indian populations. Seth and Chahal [18] have reported phenotype and allele frequency distribution data on as many as 10 differentiated cell genetic markers comprising 2 blood groups (A1, A2BO, rhd), red cell enzyme polymorphisms and haemoglobin (Hb) variants in myopia patients and controls from Patiala district of Punjab, North-West India. In the A1, A2BO system, blood group B predominated in the patient series with highest frequency (35.84%), followed by group A1 and O (both with an identical value of 24.52%) and A1B (5.66%). In controls also group B was most common (40%), followed by 0 (30%), A1 (22%) and A1B (6%).As for the ABO blood groups, Giannantoni [19] worked on myopia patients of Italy and found a relative incidence (RI) of 0.422 for A/O and 0.743 for B/O.

Another study from Italy by Scialdone and Pantalone [20] reported RI to be 2.938 and 3.150, respectively while one from Poland by Wilk et al., [21] recorded the values of 1.563 and 1.321, respectively. Pooling the data on a total of 519 myopia patients available from these three studies Mourant et al. [22] calculated a combined incidence of A/O to be 2.552 and that of B/O to be 2.620, both with very high values of χ 2 for difference from unity. Padma and Murty [23] while seeking association of genetic markers with eye diseases like cataract, corneal dystrophy, retinal detachment, primary glaucoma, myopia and strabismus found that blood group O individuals have high risk for myopia, nuclear cataract and convergent squint. Brooks and Gillies [24] assessed a series of 474 mixed cases of glaucoma for the antigenic systems ABO, Rh, ABH secretion and PTC (Phenylthiocarbamide) tasting ability and reported a significant decrease in Rh negative patients from normals in chronic closed angle glaucoma. Leske MC et al [25] evaluated association of open-angle glaucoma (OAG) with ABO, Rh and Duffy blood groups and reported an association with the Duffy Fya+. However, they had suggested a gene environment interaction. From the results of our present study, it may be concluded that the study group with refractive errors and the control group without refractive errors are gender matched pointing that there appears to be no difference between males and females as far as the refractive errors and the type of refractive errors namely myopia, hypermetropia and presbyopia are concerned in the population in and around Annamalainagar, Chidambaram. Similarly, the study group with refractive errors and the control group without refractive errors are age matched pointing that there appears to be no difference in age as far as the refractive errors are concerned in the population in and around Annamalainagar, Chidambaram. However, the study points to an association between the age of an individual and the type of refractive errors studied. Thus, it appears that myopia appears in the population at an early stage between 18 – 30 years followed by hypermetropia between 31 – 50 years and presbyopia between 51 – 60 years. From the present study it may also be concluded that blood group B predominated in the patient series with highest frequency (52.7%), followed by group O (34.2%), group A (9.7%) and group AB (3.2%). In controls group O was most common (40.1%), followed by group A (28.6%), group B (16.9%) and group AB (4.9%). The Chi-square comparison of the study and control groups for ABO blood groups revealed a statistically significant difference, suggesting an association between the group B and refractive errors. Regarding the Rhesus blood group system, the difference was found to be statistically non-significant. However, since the number of participants in the present study is small, we have to carry out the study in a larger section of the South Arcot District of Tamil Nadu in which the Annmalainagar, Chidambaram is located for confirming the results of the present study.

Conclusion

In our study reveals that ‘B’ blood group persons are found to be more affected by refractive errors followed by group ‘O’, group ‘A’ and group ‘AB’. It appears that myopia appears in the population at an early stage between 18 – 30 years followed by hypermetropia between 31 – 50 years and presbyopia between 51 – 60 years. However, since the number of participants in the present study is small we have to carry out the study in a larger section of the South Arcot District of Tamil Nadu

in which the Annamalainagar, Chidambaram is located for confirming the results of the present.

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