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Eye and Blood Groups-A Review of Literature

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***Abstract*: This paper represents an overview of Eye and blood groups-a review of literature.**

***Keywords*: Eye, blood, diseases.**

1. Introduction

During the last few years, interest in the association between blood group and certain diseases has been increasing. In case of few diseases, this association seems to have been proved. For eg. Duodenal ulcer appears to occur about 40% more often in those whose blood group is O then in persons of other blood group.[1] Diabetes Mellitus is also slightly more common in patients with blood group A.[2] The blood groups of patients suffering from several other diseases have also been investigated, but in none of these has a clear cut association been found. Identification of any association between diseases and blood groups is an excellent source of genetic researches in human. The membranes of red blood cells have several hundreds of isotopes and their structure is under control of genes that are located on different chromosomes [3].

Blood groups are cell surface antigens expressed according to well determined heritage patterns and are associated with incidence or prognosis of different diseases such as gastric carcinoma, small cell carcinoma of lung, esophagus carcinoma, lichen planus, seborrheic dermatitis, systemic lupus erythematosus and breast cancer [4-9]. Identification of association between ocular diseases and blood groups can help us to understand much more about the relationship between ocular diseases and blood groups.

2. Blood Groups

A blood group is a classification of blood, based on the presence or absence of inherited antigenic substances on the surface of red blood cells. These antigens may be proteins, carbohydrates, glycoproteins or glycolipids, depending on the blood group system. Some of these antigens are also present on the surface of other type of cells of various tissues. Several of these red blood cell surface antigens can stem from one allele and collectively form a blood group system [10]. Blood types are inherited and represent contributions from both parents. A total of 30 human blood group systems are now recognized by the International Society of Blood Transfusion.[11] The ABO system is the most important blood group system.The associated anti-A and anti-b antibodies are usually Immunoglobulin-M(IgM). ABO IgM antibodies are produced in the first years of life by sensitization to environmental substances such as food, bacteria and viruses [12].

The Rh system is the second most significant blood group system. The most significant Rh antigen is the D antigen, because it is the most likely to provoke an immune system response to the five main Rh antigens [13].

The two most significant blood group systems were discovered by Karl Landsteiner during early experiments with blood transfusion: The ABO group in 1901,[14] and in co-operation with Alexander S. Wiener, the Rhesus group in 1937.[15] The development of the Coombs test in 1945, the advent of transfusion medicine , and the understanding of hemolytic disease of the newborn led to discovery of more blood groups, and now 30 human blood group systems are recognized by the International Society of Blood Transfusion (ISBT) [16] and across the 30 blood groups, over 600 different blood group antigens have been found;[17] many of these are very rare or mainly found in certain ethnic groups. Blood type have been used in forensic science and were firmly used to demonstrate impossibility of paternity (e.g. A type AB man cannot be the father of a type O infant), but both of these uses are being replaced by genetic fingerprinting, which provides greater certainty.

3. Ocular Diseases and Blood Groups

The human eye and its adnexal structures develop from the neuro ectoderm of the neural groove and the adjoining surface ectoderm mesoderm and cells neural crest origin.[18] Ocular involvement in systemic disorders is quite frequent. It is

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imperative for the ophthalmologists as well as physicians to be well conversant with these. Many a time, the ocular manifestations may be the presenting signs and the ophthalmologist will refer the patient to the concerned specialist for diagnosis and/or management of the systemic disease [19]. Howard Reed and Shirley Platts [20] conducted a study to find out the association of blood groups and certain eye diseases. The blood of patients suffering from cataracts, glaucoma and strabismus was grouped and the distribution of their blood groups was compared with that of blood groups in volunteers at blood donor clinics. It was found that there was no significant difference between the distribution of groups among these patients and that among the controls. Garg et al. [21] did a study on primary glaucoma and blood groups. Primary glaucoma was found to be common in blood group A and B, less common ing group O and AB.

Ved LB et al [22].s investigated myopia and blood groups. 626 student's volunteers were investigated for myopia and its possible relationship with ABO blood group. The frequency distribution of various blood groups was not significantly different in myopics and emetropics. It was therefore be concluded that there is no specific blood group in ABO system which makes the individual more susceptible to myopia. Padma T et al. [23] carried out a study on association of genetic marker with some eye diseases. In this study, ocular conditions like cataract, corneal dystrophy, retinal detachment, primary glaucoma, myopia and strabismus were examined for certain genetic markers to estimate the relative risks involved. Blood group a individuals showed significantly high risk for zonular cataract, corneal dystrophy and convergent squint; group B individuals for zonular cataract and group O individuals for nuclear cataract, myopia and convergent squint.

Blika S et al [24] conducted a study on ABO-blood groups and D-antigen in simple and capsular glaucoma. ABO-blood groups and Rh-factor (D-antigen) were determined in 236 patients with primary open angle glaucoma, 104 simple and 132 capsular glaucomas. There was a statistical significant difference in the ABO-distribution between the two glaucoma subgroups, and also between the capsular-group and the control material. The simplex-group did not differ from the control material in this respect. For the Rh-group (D-antigen) no differences were found, neither between the two glaucoma subgroups nor between each of them and a reference material. Page PL et al.[25] carried out a study on association between the Li blood group and congenital cataracts in white patients, and identified a white patient with the red blood cell phenotype i, who also had congenital cataracts. However, in comparison with the strong association in Japanese patients between congenital cataracts and the i phenotype, the overall incidence of cataracts in white people with the i phenotype is much lower. In addition, the authors studied the blood of 31 white patients with congenital cataracts and found no patients with the i phenotype. Thus, a close link between genes for these traits does not appear in most white patients with i red blood cell phenotypes.

Brooks et al. [26] assessed blood groups as genetic markers in glaucoma. A series of 474 mixed cases of glaucoma were assesed to determine whether there were any genetic differences between different types of glaucoma. A careful distinction was made between chronic open angle glaucoma (COAG), acute and chronic angle closure glaucoma, ocular hypertension, low tension glaucoma, patients with large cup disc ratios, and various types of secondary glaucoma including psudoexfoliation of the lens capsule, uveitic and traumatic glaucoma. Using ABO blood groups, Rhesus groups, ABH secretion or non-secretion, and phenylthiourea testing they identified certain differences. The differences from normal were significant decrease in Rh-negative patients in chronic closed angle glaucoma ($p<0.05$), a decrease in ABH secretors in ocular hypertension ($p< 0.01$), and fewer HB secretors in patients with COAG ($p<0.02$). There was a significant decrease in AH secretors and increase in HB secretors in both pseudo exfoliation with raised intraocular pressure compared with COAG ($p< 0.01$). Leske MC et al. [27] conducted a study on Open-angle glaucoma(OAG) and blood groups(The Barbados Eye Study) . Associations were found with the Duffy Fya + group which is more frequent in white than black populations. In Mantel-Haenszel analyses, OAG was positively associated with Duffy Fya+ in men (odds ratio, 2.67; confidence interval, 1.52 to 4.69) and in person with intraocular pressure more than 21 mm Hg (odds ratio, 3.32; confidence interval, 1.49 to 7.38. Logistic regression analyses confirmed these findings (interaction of Duffy Fya+ and male gender, P = .01; interaction of Duffy Fya+ and intraocular , pressure, P = .0.4). No association between OAG and the ABO or Rh blood groups were seen.

Garcher et al [28] investigated blood group related antigens in occular cicatricial pemphigoid(OCP). Mucins in OCP patients showed a decreased expression of blood group related antigens whereas the MUC5AC peptidic core detected by anti-M1 Mab remained unchanged. These results also seem to indicate that OCP may be associated with a non-secretor phenotype. Zaree et al. [29] conducted a study on association between glaucoma and blood groups. This cross-sectional study was performed on 400 glaucomatous patients [100 patients in each group of Primary open angle glaucoma (POAG), chronic angle closure glaucoma (CACG), and pseudoexfoliative glaucoma (PEXG) and primary congenital glaucoma (PCG)] and 400 blood donors as control group to assess the association between blood groups and glaucoma. The prevalence of blood group A was 30% in the control group, 27% in POAG, 33% in CACA, 38% in PEXG and 36% in PCG. The prevalence of blood group B was 24% in the control group, 19% in POAG, 20% in CACG, 15% in PEXG and 34% in PCG ($P < 0.025$). The prevalence of blood group AB was 8% in the control group, 9% in POAG, 5% in CACG, 12% in PEXG, and 8% in PCG. The prevalence of blood group O was 38% in the control group, 45% in POAC, 42% in CACG, 35% in PEXG and 22% in PCG ($P < 0.001$). The prevalence of Rh+ was 88% in the control group, 84% in POAG, 87% in CACG, 86% in PEXG and 87% in PCG. Compared to control group, blood group B was more prevalent and blood group O was less prevalent in PCG. There was no association between other types of blood groups (ABO and Rh) and PCG. There was no association between blood

groups (ABO and Rh) and other types of glaucoma.

Kadkhoda et al.[30] carried out this study to investigate the possible association of ABO blood group and Rh with behcet's syndrome with ocular involvement.110(55%) of patients were male and 90(45%) were female. Male / Female ratio was 1.22/1. Prevalence of the disease was highest in the third decade of life (51%) Frequency of Blood group in patients was: A: 68 (34%), B 22(11%), AB 15 (75%), D 95 (47.5%) Rh (+) 74 (87%) and Rh(-) 26(13%). Frequency of Group B (11%) was significantly lower in behcet compared with controls (Group B=20%) (P-valve=0.0188) and published Data of Blood Transfusion center (Group B=23.72%) (P-value =0.01).No significant difference was found between Rh frequency in both groups and with the published data. Khan et al.[31] conducted a study on association of ABO blood groups with glaucoma in the Pakistani population. In the present study, the percentage of blood groups A, B, AB, and O in patients was found to be 19%, 41%, 10%, and 30%, and in the control group, the values were 26%, 31%, 12%, and 31%, respectively. A significant positive association was found between the B blood group and glaucoma (p value < 0.05, odds ratio [OR] 1.5, and c2 15.8). Logistic regression analysis revealed that the blood group B was associated with all types of glaucoma with OR of 1.35 (95% CI 1.01-1.80; p = 0.04) for POAG, 1.71 (95% CI 1.21-2.40; p = 0.002) for PACG, and 1.61 (95% CI 1.09-2.36; p = 0.016) for PEXG. POAG was also found to be associated with the Rh- allele (p < 0.05) with an OR of 4.05 (95% CI 2.98-5.51), as compared with controls.In the Pakistani patient cohort, blood group B is associated with all types of glaucoma and the Rh allele is associated only with POAG.

Kaiser-Kupfer MI et al [32] investigated the relation between the HLA and ABO antigens in pigment dispersion syndrome. They found no statistically significant differences in phenotype frequencies of the 36 different HLA antigens or the ABO antigens when they compared 27 white patients with pigment dispersion syndrome (18 without glaucoma and nine with glaucoma) with 323 white controls. An increase was suggested in the incidence of B7 in patients without glaucoma, and of B13 among patients with glaucoma. Jeddi Blouza A et al. [33] conducted a study to determine whether blood groups are genetic markers for primary open angle glaucoma (POAG) and found that AB groups are significantly more frequent in POAG cases (10.5%) than in the control group (2%). However, no association was found between POAG and ABO, rhesus, and Kell and Duffy blood groups even when men and women were studied separately.

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The paper being submitted has not been published, simultaneously submitted, or already accepted for publication elsewhere.

5. Conflicts of Interest

The authors declare that they have no competing interest.

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6. Conclusion

Despite various studies, there is no clear cut consensus regarding definitive association of blood groups with a particular eye disease; though time and again,various associations have been proved. Hence,further research in this aspect is warranted.

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