Association between color vision loss and risk genotype for vascular proliferation in type 2 diabetics

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Color vision is affected in diabetics, in many cases prior to diabetic retinopathy. The mechanisms for this loss and their relation to development of retinopathy remain unclear. Risk for the development of diabetic retinopathy has been associated to genetic markers for the expression of erythropoietin (EPO), with higher risk linked to the homozygous TT genotype and lower risk to the GG genotype. Here, we investigate the relationship between the EPO expression genotypes and color discrimination in type 2 diabetics without retinopathy. Discrimination thresholds along the protan, deutan and tritan axes, as well a MacAdam ellipse at CIE coordinates u' = 0.1977 v'= 0.4689 were measured in 21 patients, using the Cambridge Colour Test (Cambridge Research Systems, Ltd). The EPO markers were identified by direct sequencing from blood sample DNA. Eight patients were homozygous for the risk genotype TT, 4 had the protective genotype GG, and 9 patients were heterozygote. The color vision outcome from the patients TT TG patients was consistently worse than for the GG genotype in all the parameters measured. Mean protan, deutan and tritan thresholds ($u'v'*10^4$) were 88±13, 111±21 and 152±21 for TT carriers; 125±17, 122±29 and 253±31 for TG carriers and 64±4, 53±13 and 109±13 for GG carriers. Our results suggest association between genetic markers for retinal vascular proliferation and pre-retinopathic color vision loss. The association between losses of a highly sensitive functional parameter and risk genotypes may provide valuable information for early detection and clinical management of patients more susceptible to diabetic visual damage.

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