·Clinical Research·

Risk factor analysis of 167 patients with high myopia

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Abstract

• AIM: To analyze the risk factors of age, sex, course, best corrected visual acuity (BCVA), diopter and fundus features of high myopes with progressive high myopia.

• METHODS: A total of 167 patients with high myopes were categorized into four groups: group 1, age 10-29 years; group 2, age 30-49 years; group 3, age 50-69 years and group 4, age 70-89 years. The refractive errors of all patients were measured without cycloplegia with an autorefractometer. Data of the spherical equivalent (SE) of the refractive errors in diopters (D) and fundus examined by direct ophthalmoscope were used in statistical analysis.

• RESULTS: The number of female was statistically larger than that of male ($P<0.01$), also the disease course was correlated to the age. The visual acuity of high myopes significantly decreased as they grew older including the higher incidence of lacquer cracker, submacular hemorrhage, Fuchs spots, chorioretinal atrophy.

• CONCLUSION: Female maybe a risk factor of high myopia, advanced age is an important factor of visual acuity decreased. High myopes ought to be treated early to delay the progress of myopia and development of macular degeneration.

• KEYWORDS: high myopia; sex; age; diopter; fundus

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INTRODUCTION

Myopia is a leading cause of visual impairment [1]. High myopia is synonymous with pathologic myopia as the extreme form of myopia defined as refraction of at least -6.00 diopters, frequent cause of legal blindness, especially in younger patients [2], due to retinal detachment, macular degeneration[1] and choroidal neovascularization(CNV)[3] *etc.* It's necessary to study the epidemiology of high myopic patients by their age, sex, course, best corrected visual acuity (BCVA), refractive error and fundus. Next, we hope to find ways in delaying the progression of myopia and exploring effective treatment of pathologic myopia. Our work was conducted in accordance with the declaration of Helsinki.

MATERIALS AND METHODS

Patients A total of 167 patients 334 eyes with high myopes were studied from the Department of Ophthalmology in the Affiliated Hospital of Chengdu University of TCM. Patients were excluded if they met any one following criteria: connective tissue, disease, diabetes mellitus, amblyopia, corneal disease, cataracts, and previous ocular trauma. The spherical equivalent (SE) of refraction is at least -6.00D, and age ranged from 16 to 87 years, male 46 cases, female 121 cases. All patients were categorized into four groups: group 1, age 10-29 years with 20 cases (40 eyes); group 2, age 30-49 years with 48 cases (96 eyes); group 3, age 50-69 years with 74 cases (148 eyes) and group 4, age 70-89 years with 25 cases (50 eyes).

Methods The refractive errors of all patients were measured without cycloplegia with an autorefractometer. The spherical equivalent of the refractive errors in diopters (D) was used in statistical analysis. All fundus were examined by a direct ophthalmoscope through dilated pupil.

Statistical Analysis Using the Statistical Program for Social Sciences(SPSS)13.0 to analyze Data: χ^2 tests was performed when there were data of frequency in different groups. One-way ANOVA was used to evaluate differences in Data with normal distribution and homogeneity, variance without normal distribution and homogeneity were analyzed by nonparametric test. Both sides of variance with normal distribution were analyzed by linear Regression.

RESULTS

Sex, Age and Course There were 121 female and 46 male, and the number of female was statistically larger than that of male (Table 1). The age and course had significantly difference in different groups, from group1 to group 4. The age and course were statistically increasing (Table 2).

Table 1 Sex and age difference in high myopia

Groups	Age(yr)	*n*	Male	Female
1	10-29	20	8	12
2	30-49	48	20	28
3	50-69	74	10	64
4	70-89	25	8	17

$\chi^2=13.9$, $P=0.003$

Table 2 Age, course and SE of patients with high myopia

Groups	Age(yr)	Mean age	Course (yr)	Right SE	Left SE
1	10-29	24.5±4.4	14.0±7.1	-8.5±3.2	-8.3±3.7
2	30-49	39.9±5.3[b]	24.3±9.5[b]	-12.8±5.2[b]	-12.9±5.0[b]
3	50-69	59.1±5.1[d,f]	37.5±12.8[d,f]	-12.8±4.2[b]	-12.4±4.7[a]
4	70-89	74.9±4.4[b,f]	46.0±14.2[b,d,f]	-12.0±4.8[a]	-12.3±5.2[a]
F		522.912	39.369	5.243	4.760
P		0.000	0.000	0.000	0.000

[a]*P*<0.05, [b]*P*<0.01 *vs* group 1; [d]*P*<0.01 *vs* group 2; [f]*P*<0.01 *vs* group 3

Table 3 Regression analyze of age, course and SE

Model	Unstandardized Coefficients		Standardized oefficients	*t*	*P*
	B	Std. Error	Beta		
1（Constant）	-8.654	3.279		-2.639	0.009
Age	0.641	0.052	0.676	12.235	0.000
Left SE	0.394	0.376	0.128	1.047	0.297
Right SE	0.244	0.396	0.076	0.618	0.538

Dependent Variable: Course

Table 4 The visual acuity and fundus of patients with high myopia *n*(%)

Groups	Age(yr)	*n*	≥0.8	≥0.5＜0.8	≥0.1＜0.5	＜0.1
1	10-29	40	20(50.0)	10(25.0)	6(15.0)	4(10.0)
2	30-49	96	31(32.3)	13(13.5)	38(39.6)	14(14.6)
3	50-69	148	18(12.2)	15(10.1)	67(45.3)	48(32.4)
4	70-89	50	1(2.0)	1(2.0)	21(42.0)	27(54.0)

TN: total eye number; N: eye number; χ^2=67.168, *P*=0.000

Table 5 The fundus of patients in different groups *n*(%)

	Group 1	Group 2	Group 3	Group 4
Lacquer cracks	9(22.5)	46(47.9)	80(54.0)	22(44.0)
Subretinal haemorrhages	4(10.0)	10(10.4)	19(12.8)	7(14.0)
Fuchs spot	5(12.5)	25(26.0)	39(26.4)	15(30.0)
Choroidal atrophy	2(5.0)	18(18.8)	47(31.8)	25(50.0)
Epiretinal membrane of macula	0	2(2.1)	5(3.4)	2(4.0)
History of retinal detachment	4(10.0)	9(9.4)	4(2.7)	1(2.0)

N: eye number

SE of Both Eyes The SE of eyes in group 1 was statistically lower than that in other groups (Table 2). The SE of eyes between group 2, 3 and 4 had no significantly difference. In our Regression study, we defined age as independent variable *X* and course and SE named as dependent variable *Y* (Table 3). Also we compared the parameter of right and left SE by *t* test and found no statistical difference, so they can't enter regression analysis, last the regress equation as follows: Course = 0.641 × Age-8.654. The course of high myopes was positively correlated to the age of patients.

Visual Acuity and Fundus The visual acuity of high myopia patients is significantly declined as the age advanced (Table 4). The number of fundus with lanquer cracks, submacular hemorrhages, Fuchs spot, choroidal atrophy of high myopic patient rose while age advanced (Table 5).

DISCUSSION

Myopia, affecting an average of about 30% (3%-84%) of people throughout the world, is a leading cause of visual impairment [1]. The degree of myopia in diopters (D) is classified as follows: low (-0.75 to -2.99 D), moderate (-3.00 to -5.99 D), or high (<-6.00 D)[4]. Patients with pathologic myopia often resulting in irreversible central vision loss, developed an important cause of vision loss among working people [5]. So it's necessary to study the profile of patients with high myopia including their age, sex, course, BCVA, refractive error and fundus to explore the correlation of each other and the evidence of prevention development and progress of high myopia. In this study, among the 167 high myopia patients, there were 46 male and 121 female, we learned that the number of female were significantly higher than that of male (χ^2=13.9, *P*=0.003), the result is the same as the study of Vitale *et al* [6], He *et al* [7] and Xu *et al* [8]. It means that female may at higher risk than male. Estrogen may promote CNV development by increasing vascular endothelial growth factor receptor 2 (VEGFR2) gene

expression via ERβ . We also observed that 17β-estradiol (E2) played an important role in the regulation and modulation of VEGF, VEGFR2 mRNA, and subsequent endothelial cell proliferation [9]. This led us to question a possible role of E2 in ocular angiogenesis. The status of age and course of high myopic patients in this study, the age and course of different groups had significant difference. The SE of both eyes in group 2, 3 and 4 had no statistical differences, but these were significantly increased than that of group 1. If age named as independent variable, course and SE named as dependent variable, then make regression analysis to them and acquire regression equation: Course= 0.641×Age-8.654. From this equation, we learned that SE and age has no correlation, while course and age has correlation, which indicated that age of incidence high myopia is mostly younger. So we should pay attention to prevent the incidence and progress of adolescent myopia.

Comparing the visual acuity of high myopia in different groups, we learned that the age of high myopic patients was increasing while the rate of visual acuity ≥0.8 was declining from 50% in group1 to 2.0% in group 4. the rate of visual acuity<0.1 was increasing from 10% in group 1 to 54.0% in group 4 (χ^2=67.168, P=0.000). That may suggest that incidence of vision decreased is increasing accompanied with ageing. Ageing is an important factor in the development of vision decreased of high myopic patients and affects retinal pigment epithelium dysfunction [10]. The lacquer cracks, subretinal haemorrhages, Fuchs spot and Choroidal atrophy are the major factors to affect vision of high myopic patients. Lacquer cracks, which are yellowish linear lesions found in the posterior of high myopic eyes, are an earlier sign of myopic maculopathy. Lacquer cracks are suggested not to influence VA, except when they cross the fovea [10]. Lacquer cracks are formed by ruptures in Bruch's membrane, in which choroidal neovascularization (CNV) may develop[11]. CNV occurring in 5-10% of individuals with high myopia and high myopia is the cause of 62% of CNV in patients less than 50 years of age [3], which is the important reason of vision loss of young patients and high myopia, generally leads irreversible central vision loss [12]. In CNV eyes may indicate that the functional impairment is present, not only in the outer macular layers (preganglionic elements), but also in the innermost macular layers (ganglion cells and their fibers). These new vessels leak blood and fluid and cause a build-up of fibroblasts and neovascular endothelial cells between and within the RPE and photoreceptor layers causing. In the early stages, a detachment of the RPE and retina. A persistent fibrovascular scar subsequently forms with a progressive loss of photoreceptors [11]. Pathologic myopia is associated with progressive stretching and thinning of the posterior pole and choroid with loss of choriocapillaries. The elongation of the globe causes vascular alterations, breaks in Bruch's membrane (lacquer cracks) with increased risk of CNV, besides progression of myopic macular chorioretinal atrophy[13].

In our study, some high myopic patients with spontaneous subretinal haemorrhages, which may developed by lacquer cracks formed by ruptures in Bruch's membrane, CNV, small fibrovascular tissue ingrowths which may cause elevated pigmented circular lesions (Fuchs' spots)[14], around which sometimes combined with haemorrhages. All predispose high myopes to rapid visual loss. In this study, we found that aging high myopic patients with declined vision acuity and worse retina was usually worse than that of young patients. So it's necessary to follow up young high myopic patients to prevent the development of pathologic myopia and macular degeneration.

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