· Original article ·

Risk factor analysis of 167 patients with high myopia

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Abstract

• AIM: To analyse 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 of 29 years or younger; group 2, between the age of 30 to 49 years; group 3, between the age of 50 to 69 years and group 4, age of 70 years or older. 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 examed by direct ophthalmoscope were used in statistical analyses.

• 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 decrease. 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.

PATIENTS AND METHODS

Patients A total of 167 patients 334 eyes of 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 of the following criteria: connective tissue disease, diabetes mellitus, amblyopia, corneal disease, cataracts, previous ocular trauma. The spherical equivalent (SE) of refraction is at least -6.00D, age ranged from 16 to 87 years, male 46 cases, female 121 cases. All patients were categorized into four groups: group 1, age of 29 years or younger with 20 cases and 40 eyes; group 2, between the age of 30 to 49 years with 48 cases and 96 eyes; group 3, between the age of 50 to 69 years with 74 cases and 148 eyes and group 4, age of 70 years or older with 25 cases and 50 eyes.

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

Statistical Analysis Using the Statistical Program for Social Sciences (SPSS) 13.0 to analyze data: χ^2 test 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 significant difference in different groups, from group 1 to group 4 the age and course were statistically increasing (Table 2).

SE of Both Eyes The SE of eyes in group 1 were statistically lower than those in other groups (Table 2), the SE of eyes between group 2, 3 and 4 had no significant

Table 1 Sex and age difference in high myopia

Age group	*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

Group	Age(yr)	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,d,f]	46.0 ±14.2[b,d,f]	-12.0 ±4.8[a]	-12.3 ±5.2[a]

[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 analysis of age, course and SE

Model	Unstandardized coefficients		Standardized coefficients	*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

a Dependent Variable: Course

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

Group	*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)

N: eye number; $\chi^2=67.168$, $P=0.000$

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

difference. In our regression study, we defined age as independent variable χ 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 analyze, 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 classifed as follows: low (-0.75 to -2.99D), moderate (-3.00 to -5.99D), or high (<-6.00D)[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 of development and progress of high myopia. In this study, among the 167 high myopia patients, there are 46 male patients and 121 female patients, we learned that the female patients are significantly higher than male patients ($\chi^2=13.9$, $P=0.003$), 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 have significant difference. The SE of both eyes in group 2, 3 and 4 has no statistical difference between them, but the SE of the three groups are significantly increased than that of group 1. If age is named as independent variable,

course and SE named as dependent variable, then make regression analysis on them and we can 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.

Compare the visual acuity of high myopia in different groups, we learned that the age of high myopic patients is increasing while the rate of visual acuity ≥0.8 is declining from 50% in group1 to 2.0% in group 4. The rate of visual acuity <0.1 is increasing from 10% in group 1 to 54.0% in group 4 (χ^2 = 67.168, P = 0.000), which may suggested that incidence of vision decrease is accompanied with ageing. Ageing is an important factor in the development of vision decrease 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, indicates 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 stage, 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 can lead to rapid visual loss. In this study, we found that aged 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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高度近视患者 167 例临床分析

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摘要

目的:分析不同年龄阶段高度近视患者的性别、年龄、病程、视力、屈光度、眼底等情况并探讨它们与高度近视发生的风险,视力与屈光状态及眼底情况的关系,为防止高度近视的发生、发展提供一定依据。

方法:根据年龄将高度近视患者分为4组:组1,年龄≤29岁的患者;组2,年龄为30~49岁;组3,年龄为50~69岁;组4,年龄为≥70岁。非睫状肌麻痹状态下自动验光仪验光,取等效球镜进行屈光度计算。用直接眼底镜行眼底检查,结果行相关统计学分析。

结果:各组男女患者比例有显著性差异,女性显著多于男性($P<0.01$),高度近视患者的年龄和病程有相关性,年龄越大的患者其病程越长。随着年龄增加,高度近视患者的视力显著的下降,且眼底出现漆裂纹、黄斑出血、Fuchs斑、脉络膜萎缩灶的比率呈增加趋势。

结论:女性可能是高度近视发生的风险因素之一,年龄增加是导致高度近视患者视力下降的一个重要因素,对高度近视患者宜进行早期治疗,以防治近视的发展及黄斑病变的发生。

关键词:高度近视;性别;年龄;屈光度;眼底

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