·Investigation·

Prevalence of refractive errors in middle school students in Lanzhou city

Yi Sun, Hong Cao, Zhen-Guo Yan

Department of Ophthalmology, Lanzhou General Hospital of Lanzhou Military Area Command, Lanzhou 730050, Gansu Province, China

Correspondence to: Yi Sun. Department of Ophthalmology, Lanzhou General Hospital of Lanzhou Military Area Command, Lanzhou 730050, Gansu Province, China. endimion@163.com

Received:2008-04-02 Accepted:2008-05-10

Abstract

• AIM: To assess the prevalence of refractive errors in middle school students in Lanzhou city and explore the risk factors for myopia.

• METHODS: A cross-sectional survey was conducted. A questionnaire assessed the students' socioeconomic background and visual tasks followed by visual acuity assessment and a full eye examination including slit-lamp examination, fundus evaluation, retinoscopy, and subjective refraction.

• RESULTS: Among 2 256 enumerated students aged 15-19 years,2 037(90.3%) students had significant refractive errors. Myopia was the leading refractive error (1 951/2 256, 86.5%), astigmatism was the second most common refractive error (921/2 256, 40.8%), but amblyopia (10/2 256, 0.4%), strabismus (5/2 256, 0.2%), hyperopia (4/2 256, 0.2%) and other treatable eye disorders were uncommon. Almost 95.3% of students with significant refractive errors wore spectacles before the survey. Age, sex, visual tasks, and a parental history of myopia were risk factors for myopia.

• CONCLUSION: The prevalence of refractive errors and the risk factors for myopia in schoolchildren in Lanzhou city are similar to those reported in other regions of China. Interventions of myopia progression should be performed to protect the visual acuity of school-aged students.

• KEYWORDS: refractive errors; schoolchildren; prevalence; risk factor

Sun Y, Cao H, Yan ZG. Prevalence of refractive errors in middle school students in Lanzhou city. *Int J Ophthalmol*2008;1(2):180-182

INTRODUCTION

Refractive error, especially myopia, is the most common ocular disorder. All myopes must endure the physical and financial burden of spectacles and/or contact lenses and myopia may affect career choices and social activities. Persons with a high degree of myopia, particularly those with degenerative or pathologic changes, also have a higher risk of the development of permanent visual impairment or blindness from macular degeneration, retinal detachment, glaucoma, and cataract[1-5].

Prevalence of myopia varies in different areas. Japan [6] reported an overall prevalence of 50%. Nepal [7] reported a prevalence of 4.3% in a total of 1100 children. In China, Taiwan [8] reported a prevalence of 84% in people by 16 years of age. Hong Kong [9] reported myopia was the most common refractive error and was found in 36.71%±2.87% of children. Xi'an reported a prevalence of 94% in middle school students with average age of 16-18 years old [10]. But there is no report about prevalence of refractive errors in middle school students in Lanzhou city. The purpose of our study is to explore the prevalence of refractive errors in middle school students in Lanzhou city and investigate the risk factors of myopia.

MATERIALS AND METHODS

Study Population and Sampling A school-based prevalence survey on myopia was conducted in Lanzhou city from September 2006 to May 2007. A total of 2 256 students in five middle schools were randomly selected in the study. We randomly selected five middle schools from more than 30 middle schools in Lanzhou city. From each school, ten to fifteen classes were randomly selected for the study, and all children in the selected classes were invited.

Questionnaire and Ophthalmic Examination A detailed questionnaire was employed. The questionnaire contained questions about the student's visual tasks, including the number of hours they spent reading for pleasure, studying outside school hours, watching television, using computer (work or games). The students estimated the average

number of hours they spent doing each of these per week.

Having completed the questionnaire, the students then had their visual acuity (VA) examined. Both eyes were tested separately. A line on the chart was accepted as being read if the direction of more than half of the optotypes had been identified correctly. If the VA was below 0.6 in one or both eyes, a pinhole test was performed. Everybody with suspected refractive errors underwent non-cycloplegic objective and subjective refraction by the optometrist, and the corrected VA was examined. Using a torch, slit-lamp and direct ophthalmoscope, the ophthalmologist inspected all the students' eyes for abnormalities of position and motility, the anterior segment, the optic disc, and the macula.

Data Processing and Analysis All data were independently entered into computers. Range and consistency checks were done on all variables. Statistical tests of significance were conducted using 2 tests for proportions or for trend as appropriate. Unvaried analyses and multivariate logistic regression adjusting for age, sex, and other significant variables were performed via SPSS 11.0 software.

RESULTS

Prevalence of Refractive Error Poor eyesight, defined as uncorrected unilateral or bilateral VA worse than 0.6 was present in 651/2 256 (28.9%) students. 21.1% of students had bilateral poor eyesight and 7.8% had unilateral poor eyesight. The majority of students with refractive errors were myopia (1 951/2 037, 95.8%). The prevalence of significant myopia was 86.5% (1 951/2 256). Astigmatism was also present in 859 of the 1 951 myopic students (44.0%), and 62 students appeared astigmatism alone. Strabismus (5/2 256, 0.2%) and amblyopia (10/2 256, 0.4%) were rare .

Prevalence of Myopia A total of 2 256 students participated in the study, including 1 119 girls (49.6%) and 1137 boys (50.4%), aged 15 to 19 years (mean=17.42±1.15). Myopia was the most common type of refractive error. It was found in 86.5% of the children. The average refractive error of these myopic eyes was -2.33D. Mild myopia (-0.50 to -2.99D) was found in 64.9% (1 464/2 256) of children, moderate myopia (-3.00 to -5.99D) in 19.4% (438/2 256), and severe myopia (≤-6.00D) in 2.2% (49/2 256). Astigmatism was the second most common refractive error, present in 40.8% (921/2 256, range, -0.50 to -5.75D) of the study subjects. The frequency of anisometropia was 18.6% (419/2 256, range, 1.00-9.25D).

Significant myopia: associations with age, sex, and parental history of myopia In multivariate models controlled for age and gender, increasing age was associated with increased risk of having myopia. Boys on average had more myopic refractive error than girls, and the difference was significant (P=0.0397). The prevalence of myopia among boys was 88.2% (1 003/1 137) compared with 84.7% (948/1 119) in girls. Significant myopia was more common in students who were male (OR: 1.47, P=0.004), in the elder age group of 18-19 years (OR: 2.83, P<0.001), and who had a parental history of myopia (OR: 1.81, P=0.002).

Significant myopia: associations with visual tasks Students reported spending an average of 2.6 hours per week reading for pleasure and 19.0 hours studying outside school hours. Myopic students reported spending 4.5 hours per week more studying than non-myopic students (P=0.013). Hours spent studying, watching television and working or playing on a computer were similar in myopes and non-myopes.

DISCUSSION

Myopia was the most common eye problem found in middle school students in Lanzhou city, responsible for 95.8% (1 951/ 2 037) of all refractive errors. Astigmatism was the second most common refractive error (921/2 256, 40.8%). Compared with myopia and astigmatism, strabismus and amblyopia were uncommon. The published information on refractive errors in middle school students showed a wide range of prevalence [10-13]. This study's prevalence of 90.3% for refractive errors and 86.5% for myopia is similar to the reported range.

In this study, the factors that were found to be significantly associated with myopia were male sex, elder age, and parental history of myopia. These were similar to factors that have been reported[14].

Myopia was more common in boys and in children aged 18-19 years. Most studies found no difference between boys and girls [15-17], but our study showed a higher prevalence of myopia in boys, we supposed that boys usually spent more time on computer games and watching TV, which may cause the higher prevalence. The most likely explanation for the higher prevalence of myopia in children aged 18-19 years was study pressure, since these children had to be busy preparing for the University Entrance Examination, they had to spend more time on reading and writing, moreover, almost no relaxation.

Studies in China and North America have suggested that juvenile onset myopia may be inherited as a complex trait involving genetic and environmental factors [18-20]. Our study proved the same result. Visual tasks have been shown to be associated with myopia in several populations worldwide [17,21]. In our study, significant difference was found between myopes and non-myopes in reported hours in studying outside school hours.

In conclusion, Lanzhou city has a high prevalence of myopia

in the school-aged students, and it is likely that both the rate and severity of myopia will increase over time. Risk factors for myopia in Lanzhou city middle school population are similar to other regions of China, namely, age, sex, visual tasks, and a family history of myopia.

With the availability of these basic epidemiologic parameters, we are now in a better position to intervene the progression of myopia. Systematic program for protecting visual acuity of schoolchildren should be developed. Furthermore, study on the interaction between genetic and environmental factors should be carried on to further explore the mechanism of refractive errors.

REFERENCES

1 Hochman MA, Seery CM, Zarbin MA. Pathophysiology and management of subretinal hemorrhage. *Surv Ophthalmol* 1997;52:195-213

2 Fan DS, Li KW, Lam DS. Retinal complications after cataract extraction in patients with high myopia. *Ophthalmology* 1999;106:688-691

3 Banker AS, Freeman WR. Retinal detachment. *Ophthalmol Clin North Am* 2001; 14: 695-704

4 Galassi F, Sodi A, Ucci F. Ocular haemodynamics in glaucoma associated with high myopia. *Int Ophthalmol* 1998;22:299-305

5 Lim R, Mitchell R, Cumming RG. Refractive associations with cataract: The Blue Mountain Eye Study. *Invest Ophthalmol Vis Sci* 1999;40:3021-3026

6 Hosaka A. Population studies-myopia experience in Japan. Acta Ophthalmol Suppl, 1988;185:37-40

7 Nepal BP, Koirala S, Adhikary S, Sharma AK. Ocular morbidity in schoolchildren in Kathmandu. *Br J Ophthalmol* 2003;87:531-534

8 Lin LL, Chen CJ, Hung PT, Ko LS. Nation-wide survey of myopia among school children in Taiwan, 1986. *Acta Ophthalmol Suppl* 1988;185:29-33

9 Fan DSP, Lam DSC, Lam RF, Lau JTF, Chong KS, Cheung EYY, Lai RYK, Chew SJ. Prevalence, incidence, and progression of myopia of school children in Hong Kong. *Invest Ophthalmol Vis Sci* 2004;45:1071-1075

10 Shi YN, Zhao HY, Cao WJ, He P. The cross-sectional study of dynamic refractive status of senior middle school students in urban school of Xi'an city. *Int J Ophthalmol(Guoji Yanke Zazhi)* 2005;5(5):1045-1048

11 Grosvenor T. Myopia in Melanesian school children in Vanuatu. Acta Ophthalmol Suppl ,1988;185:24-28

12 Zylbermann R, Landau D, Berson D. The influence of study habits on myopia in Jewish teenagers. J Pediatr Ophthalmol Strabismus, 1993;30:319-322 13 Lin LL, Shih YF, Tsai CB, Chen CJ, Lee LA, Hung PT, Hou PK. Epidemiologic study of ocular refraction among schoolchildren in Taiwan in 1995. *Optom Vis Sci* 1999;76: 275-281

14 Saw SM, Katz J, Schein OD, Chew SJ, Chan TK. Epidemiology of myopia. *Epidemiol Rev* 1996; 18: 175-187

15 Maul E, Barroso S, Munoz SR, Sperduto RD, Ellwein LB. Refractive error study in children: results from La Florida, Chile. *Am J Ophthalmol* 2000;129:445-454

16 Pokharel GP, Negrel AD, Munoz SR, Ellwein LB. Refractive error study in children: results from Mechi Zone, Nepal. Am J Ophthalmol ,2000;129:436-444

17 Yap M, Wu M, Wang SH, Lee FL, Liu ZM. Environmental factors and refractive errors in Chinese school children. *Clin Exp Optom* 1994;77:8-14

18 Pacella R, McLellan J, Grice K, Del Bono EA, Wiggs JL, Gwiazda JE. Role of genetic factors in the etiology of juvenile-onset myopia based on a longitudinal study of refractive error. *Optom Vis Sci* 1999;76:381-386

19 Wu MM, Edwards MH. The effect of having myopic parents:an analysis of myopia in three generations. *Optom Vis Sci* 1999;76:387-392

20 The Framingham Offspring Eye Study Group. Familial aggregation and prevalence of myopia in the Framingham Offspring Eye Study. *Arch Ophthalmol* 1996;114:326-332

21 Richler A, Bear JC. Refraction, near-work and education. *Acta Ophthalmol* 1980; 58: 468-478