Original Article

Myopia Related Retinal Changes-A study in Eastern India

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Abstract:

Introduction : Myopia is an increasing public health concern, with prevalence estimates as high as 80% in selected regions of East Asia among younger persons. The most common pathologies included optic nerve crescent, white-without-pressure, lattice degeneration, microcystoid degeneration and pigmentary degeneration.

Aims And Objectives :This study was conducted with the aim of determining the prevalence of Myopia related optic disc and retinal changes in 8-50 years Eastern Indian patients without confounding ocular and systemic diseases, to find out relevant information regarding the pattern of Myopia related Retinal changes with respect to severity of Myopia and age of presentation and to find out the correlation of pattern of myopia related retinal changes with axial length and sex distribution.

Materials And Methods : Eastern Indian population in the age group of 8-50 years presenting in the Out Patient Department of Regional Institute of Ophthalmology, Medical College, Kolkata was selected for study

Results : Tessellated fundus (75%) with peripapillary atrophy (67%) were seen in most of the eyes. These two changes were the most common findings in our study. Lattice with or without holes were seen in 21% of the eyes. White with or without pressure areas were found in 41% of the eyes and Paving stone degeneration were seen in 26% of the eyes

Conclusion : Given the alarming rates of myopia in Asia, there will be an enormous adult population at high risk of developing pathologic myopia. We have documented the 2 most common fundus findings, staphyloma and lattice in adolescents and adults.

.**Keywords:** Myopia, Retinal Changes, Eastern India

Introduction

The Greek word Myopia means to close or contract the eye. Myopia (Ancient Greek: μυωπία, muōpia, from myein "to shut" – ops (gen. opos) "eye". [(1)]. The term Myopia was introduced from the habit which short sighted people frequently have of half closing the eyelids when looking at distant objects. Myopia is an increasing public health concern, with prevalence estimates as high as 80% in selected regions of East Asia among younger persons. [(2–8)] The most common pathologies included optic nerve crescent, white-without-pressure, lattice degeneration, microcystoid degeneration and pigmentary degeneration[9] .High myopia was also

suggested to be associated with bilateral rhegmatogenous retinal detachment, a condition of very severe visual morbidity. This study was conducted with the aim of determining the prevalence of Myopia related optic disc and retinal changes in 8-50 years Eastern Indian patients without confounding ocular and systemic diseases, to find out relevant information regarding the pattern of Myopia related Retinal changes with respect to severity of Myopia and age of presentation and to find out the correlation of pattern of myopia related retinal changes with axial length and sex distribution.

Aims And Objectives

- To find out the prevalence of Myopia related optic disc and retinal changes in 8-50 years Indian patients without confounding ocular and systemic diseases.
- To find out relevant information regarding the pattern of Myopia related Retinal changes with respect to severity of Myopia and age of presentation.
- To find out the correlation of pattern of myopia related retinal changes with axial length and sex distribution.

MATERIAL AND METHODS

We included Eastern Indian population in the age group of 8-50 years presenting in the Out Patient Department of Regional Institute of Ophthalmology, Medical College, Kolkata. The age group of 8-50 years was taken so as to cover almost all the age groups of the society along with having an easy examination process and to avoid lenticular opacities in the elderly. A total of 150 patients were included. Prior to the study an informed consent was taken from all the patients and ethical clearance was obtained from the institute Ethics committee .This is an institution based cross sectional descriptive study for a period of about 1.5 years (January, 2015 – June, 2016)

Exclusion criterion: Persons from the age group less than 8 years and more than 50 years were not included. Emmetropes were not taken into this study. Patients with a known history of any ocular or systemic diseases were also excluded.

Procedure:A detailed case history was taken along with socio economic background in view of hereditary contribution in Myopia and for any correlation of myopia to socio economic background. Any history of contact lens wear was elicited along with any history of past refractive surgery.Visual Acuity was noted with the help of Snellens chart. Best corrected visual acuity was then measured using standard refraction protocol. Spherical equivalent was calculated as sum of spherical power and half of cylindrical power. A detailed slit lamp examination of both eye anterior segment was done. Intra Ocular Pressure was measured with the help of Applanation Tonometry. Mydriasis was achieved with the help of tropicamide and phenylephrine combination.Fundus examination by direct ophthalmoscope and binocular indirect ophthalmoscope with 20 Dioptre lens of both eye was done. The media, disc, vessels, macula, peripheral retina were examined with the help of scleral indenter. Myopic macular chorioretinopathy was given a grade based on Avila classifications (M0 – M5)[10] .M0 representing normal fundus, M1 representing fundus pallor and tessellation, M2 representing M1 plus posterior pole staphyloma, M3 representing M2 plus lacquer cracks, M4 representing M3 plus focal deep chorioretinal atrophy and M5

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representing M3 plus large geographic area of deep chorioretinal atrophy.

Axial length was then measured using USG B Scan.

Statistical analysis:

We examined the association of various fundus and disc changes with age, sex, spherical equivalent and axial length. The relationship was assessed using the chi-square and fischer exact test. P values of <0.05 were statistically significant.

RESULTS AND ANALYSIS

AGE INCIDENCE IN THE STUDY GROUP

Table 1: Age incidence

Age Group	Total	Percentage
0-19	102	34%
20-29	86	29%
>=30	112	37%
Total	300	

SEX INCIDENCE IN THE STUDY GROUP

Table 2: Sex incidence

Sex	Total	Percentage
Male	122	41%
Female	178	59%
Total	300	100%

CLASSIFICATION OF MYOPIC PATIENTS IN THE STUDY GROUP ACCORDING TO SPHERICAL EQUIVALENT

Table 3: Spherical Equivalent

SER	Total	Percentage
-4 to -6.99	146	49%
-7 to -9.99	49	16%
>=-10	105	35%
Total	300	100%

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CLASSIFICATION OF MYOPIC PATIENTS IN THE STUDY GROUP ACCORDING TO AXIAL LENGTH

Axial Length	Total	Percentage
1st Quartile	65	22%
2nd Quartile	81	27%
3rd Quartile	74	25%
4th Quartile	80	27%
Total	300	100%

Table 4: Axial Length

PREVALENCE OF TYPES OF RETINAL AND OPTIC DISC CHANGES IN THE STUDY GROUP

Fundus/ optic Disc changes	Total Count	Percentage
Lattice	63	21%
Peri Papillary Atrophy	202	67%
Disc Tilt	144	48%
White Without Pressure	123	41%
Paving Stone	78	26%
M0	68	23%
M1	226	75%
M2	64	21%
M3	15	5%
M4	5	2%
M5	0	0%
Retinal detachment	1	1%
Total	300	100%

Table 5: Changes types

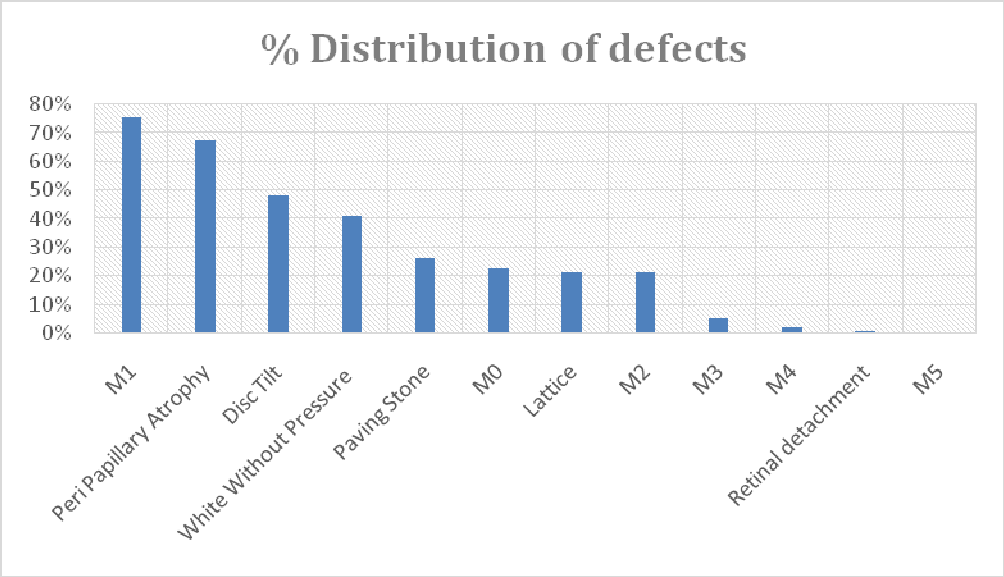

Chart 1: Changes types

In the study group there were a total of 150 subjects or 300 eyes with spherical equivalent of power more than -4. Table 1 shows the distribution of Myopia was highest in the age group of >=30 years (112 eyes; 37%) followed by the age group 0-19 years (102 eyes; 34%) followed by 20-29 years (86 eyes; 29%). Table 2 shows the distribution of Myopia to be more in females (178 eyes; 59%) as compared to males (122 eyes; 41%). 8% of the cases had a positive family history. Table 3 and chart 3 shows the patients' distribution of the study group with respect to refractive errors. A total of 146 eyes (49%) had a refractive error between -4 to -6.99 followed by 105 eyes (35%) had a refractive error of more than -10. A total of 49 eyes (16%) had a refractive errors between -7 to -9.99. Table 4 shows the patients' distribution with respect to axial lengths. A total of 4 quartiles of axial lengths were obtained with first quartile (<23mm), second quartile (23 to 24.99mm), third quartile (25 to 26.99 mm) and fourth quartile (>27mm). Table 5 and Chart 1shows the prevalence of different Myopic fundus and disc changes in the study group. Tessellated fundus (75%) with peripapillary atrophy (67%) were seen in most of the eyes. These two changes were the most common findings in our study. Lattice with or without holes were seen in 21% of the eyes. White with or without pressure areas were found in 41% of the eyes and Paving stone degeneration were seen in 26% of the eyes. Disc tilt was found in 48% of the eyes. Posterior staphyloma was found in 21% of the eyes. The prevalence of lacquer cracks and chorioretinal atrophy at the posterior pole were seen to be 7% and 4% respectively. Fuch's spot (small pigmented sub retinal lesion at posterior pole) representing scar phase of myopia choroidal neovascularization, active myopic choroidal neo vascularization, geographical atrophy were also evaluated one eye each of Fuch's spot choroidal neo vascularization and retinitis pigmentosa were seen.

It was found that Lattice, peri papillary atrophy, disc tilt, tessellation and staphyloma increased in prevalence with increasing age. (p values were respectively 0.26, 0.09, 0.03, 0.55 and <0.0001). The

incidence of normal fundus decreased with increasing age. It was found that in general sex didn't alter the prevalence of various myopic fundus and disc findings. When the relationship between myopic fundus and disc findings with spherical equivalents was studied it was noted that, the risk of lattice was maximum in the group -7 to -9.99 (31%) followed by 20% in the group -4 to -6.99. The least risk of lattice was in the group >=-10 (18%). The risk of Peri Papillary atrophy was seen to increase with increase in spherical equivalent (p value <0.0001). Similarly the risk of disc tilt was seen to increase with increase in spherical equivalent (p value <0.0001). The incidence of white with or without pressure areas is more or less equal in all the spherical equivalent groups. Paving stone degeneration was most commonly found in the spherical equivalent group of -7 to -10 (15 eyes, 31%). The risk of tessellation and staphyloma were also seen to increase with spherical equivalent (p value <0.0001). Most of the patients with normal fundus were in the group of -4 to -7 (p value <0.0001). Correlation between the incidence of various myopic fundus and disc changes grouped according to axial length quartiles found that the risk of peri papillary atrophy, disc tilt, staphyloma, tessellation increased with increasing axial length (p values <0.0001 for all). High Avila grading scores were associated with longer axial length values.

Discussion

A total of 300 eyes of 150 patients were taken in the age group 8 to 50 years with spherical equivalent power more than -4Dioptre and were analysed. According to our study in Eastern Indian population aged 8 to 50 years with spherical equivalent power more than -4 dioptres fundus pallor, tessellation (226 eyes, 75%), peripapillary atrophy(202 eyes, 67%) and optic disc tilt (144 eyes, 48%) were very common findings. It was followed by white with or without pressure areas (123 eyes, 41%), Paving stone degeneration (78 eyes, 26%), lattice (63 eyes, 21%), Posterior pole staphyloma (64 eyes, 21%). Second most common disc finding after peri papillary atrophy was found to be tilted disc (144 eyes, 48%). Lacquer crack (15 eyes, 5%), Fuch's spot (1 eye, <1%), Choroidal neo vascularization (1 eye, <1%), retinal detachment (1 eye, <1%) were noted in a few cases showing that these were very rare complications.The major pathologic findings among the aove were lattice, staphyloma, chrioretinal atrophy, lacquer cracks, fuch's spot, choroidal neovascularization and large geographical atrophic patches.The presence of staphyloma and lattice in addition to peri papillary atrophy and tilted disc contrasts with the results of Singapore teenager study where Staphyloma and chorio retinal atrophy were not present and only peri papillary atrophy and tilted discs were common in young subjects with myopia [11]. Thus pathological myopia may be a disease that is dependent on duration of the disease and there is a lag phase from the onset of high myopia, often in the teenage years, to the presence of common macular lesions such as staphyloma and lattice. Duration of myopia thus could be related to various pathologic lesions. This could explain why staphyloma and lattice were not present in the younger generation as they were children with a relatively shorter duration of high myopia. Kobayashi et al also evaluated the fundus characteristics of highly myopic (-4D or more) 46 children (80 eyes) [12]. Children were seen consecutively during a 10 year period. They also showed that myopic fundus changes are uncommon and mild in children. They suggested that ageing in

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addition to mechanical stretching of eye ball might be important for the development of myopic fundus changes. Our study too showed that various myopic fundus changes increased with age like lattice (p value = 0.26), peri papillary atrophy (p value = 0.09), disc tilt (p value = 0.03), tessellation (p value = 0.55) and posterior pole staphyloma (p value < 0.0001). Although the data was statistically significant only for posterior post staphyloma and disc tilt. Our study showed that there were no correlation between any fundus finding and sex of the patient which corroborates with the finding of Singapore Myopic adult study[13]. Our study showed the high prevalence of peri papillary atrophy (67%), tessellation (75%), disc tilt (48%). The prevalence of lattice was 21%, white with or without pressure areas was 41%, paving stone degeneration was seen in 26%, posterior pole staphyloma was seen in 21% of the eyes, chorio retinal atrophy was seen in 2%. Absolutely normal fundus findings were seen in 23% of the eyes. In Singapore adult myopic eye study , fundus pallor and tessellation was found in 90%, peri papillary atrophy was found in 81.2%, disc tilt was found in 57.4% and staphyloma was found in 23%. The very high prevalence of tessellation and peri papillary atrophy in Singapore adult myopic eye study could be attributed to the different age group considered in their study. In the study conducted on highly myopic eyes of young Asian adolescents[14], the main optic disc findings were peri papillary atrophy (97.3%) and disc tilt (27.5%). The most common myopic macular finding included posterior staphyloma (43.8%), chorio retinal atrophy (8.4%) and lacquer crack (1%). The most common peripheral retinal findings were white without pressure areas (57.2%), lattice degeneration (16.6%) and retinal tear/ detachment (4.3%). In the cross sectional study of 200 Iraqi patients with high myopia at Alkadhimiya teaching hospital in Baghdad and Al-Sadr teaching hospital in Basrah[15]fromJuly 2008 to March 2010, 61% of the patients showed posterior vitreous detachment, 33% patients had pigment clumps, 27% patients had paving stone degeneration, 12% patients had snow flakes degenerations, 10% patients had lattice, 5% patients had peripheral cystoid degeneration, 3% patients had white without pressure degeneration and only 10% patients had normal retinal findings. Thus we can say that the prevalence of various myopic fundus and disc changes in our study more or less corroborates with the Asian studies.In our study the prevalence of lattice amongst the whole study group was 21% with maximum prevalence in the spherical equivalence group of -7 to -9.9 (31%). Lai Fen et al in 2008 conducted a cross sectional community based study in Chinese subjects with high myopia [16]. They found that younger age and higher degree of refractive error were associated with the presence of peripheral retinal lesions (p values = 0.046 and 0.002 respectively). In our study, peri papillary atrophy, disc tilt, tessellation and staphyloma were found to be associated with increasing spherical equivalents (p values less than 0.0001 in all cases). In Singapore adult myopic eye study , peri papillary atrophy (p value = 0.05), tessellation (p value < 0.001), staphyloma (p value <0.001)and chorio retinal atrophy (p value <0.001) increased in prevalence with increasing refractive error. So the results of our study that peri papillary atrophy, disc tilt, tessellation and staphyloma increases with spherical equivalent corroborates with the Singapore adult myopic eye study. Our study also found that peri papillary atrophy, disc tilt and staphyloma increased with

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increase in axial length (p value < 0.0001 in all cases.The Singapore adults myopic patients also found that staphyloma and chorio retinal atrophy increased in prevalence with increasing age, increasing myopic refractive error and increasing axial length (p values less than 0.001 in all cases). In a cross sectional study on Hong Kong Chinese teenage subjects with high myopia, after adjusting for myopia over -8 Dioptres, age, gender, duration of myopia, family retinal history and intra ocular pressure binary logistics regression showed that an axial length longer than 26.5mm was a significant risk factor for peripheral retinal changes, optic nerve crescents and white without pressure areas [17.] Victor, Ching Yu et al[18] conducted a study in which they found that Longer axial length was significantly associated with most lesions including optic disc tilt (odds ratio [OR] 1.31; 95% CI: 1.15, 1.51), peri papillary atrophy (OR 2.45; 95% CI: 1.44, 4.15), posterior staphyloma (OR 1.80; 95% CI: 1.56, 2.08), chorioretinal atrophy (OR 1.92; 95% CI: 1.53, 2.41), peripheral lattice degeneration (OR 1.30; 95% CI: 1.10, 1.52), and white-without-pressure (OR 1.21; 95% CI: 1.07, 1.38).In our study only 15 eyes were identified with lacquer cracks but more so in those with higher myopic refractive errors (p value = 0.0006) and longer axial lengths (p value = 0.0153). This suggests that these breaks in Bruch's membrane are highly associated with advanced myopia and axial elongation. It is likely that our study represents an underestimation of the true prevalence of lacquer cracks because of not using angiographic diagnostic tools. Another imaging modality for detection of lacquer cracks that could be considered for future studies would be auto fluorescence. In our study only one patient had Fuch's spot in both eyes and one eye had retinal detachment pointing to the fact that these are relatively rare extreme complications of myopia.

Conclusion

Our study has considerable implications. This study comprised a large collection of highly myopic subjects who are fairly representative of the general population. Given the alarming rates of myopia in Asia, there will be an enormous adult population at high risk of developing pathologic myopia. We have documented the 2 most common fundus findings, staphyloma and lattice in adolescents and adults. Finally,the increasing prevalences of staphyloma with more severe refractive error in our study emphasizes that preventive strategies to slow the progression of myopia in childhood to prevent the eventual development of extreme myopia in adulthood are important. However a limitation of our study lies in the fact that,our study is cross-sectional in nature and the temporal sequence of progression of lesions cannot be documented. The lack of peripheral and stereoscopic views may have limited the detection and characterization of staphylomata

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