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Prevalence of Pathological Myopia and Its Association with Ocular Disorders

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Abstract

Introduction: Pathological myopia (PM) is defined as the presence of structural changes due to axial elongation in eyes with high myopia. Numerous vision-threatening conditions are known to be more prevalent in eyes with pathological myopia including retinal detachment, myopic retinoschisis, macular holes, choroidal neovascularization, and chorioretinal atrophy. These pathological changes often lead to progressive loss of vision. Present study was conducted to find out the burden of pathological myopia and its associated factors at a tertiary care centre. **Materials and Methods:** A hospital based cross sectional study was conducted including a sample size of 345 with at least -5.0 D spherical equivalent of myopia in both eyes. Each subject was interviewed followed by extensive ophthalmologic screening examination, including measurements of visual acuity and fundus examination by Direct & Indirect Ophthalmoscopy. Data was analysed using SPSS ver. 21.0 using appropriate statistical tests. **Results:** Prevalence of pathological myopia among myopia cases between 7 to 40 years old was 9%. Among 31 cases of pathological myopia, juvenile and youth onset was seen in 29% cases each while early adult onset was seen in 41.9% cases. Prevalence was more in females (12.4%) as compared to males (5.7%). Low visual acuity, high spherical/ cylindrical error and high intra-ocular pressure were significantly associated with pathological myopia. Mean axis length in both right and left eye was significantly more in cases with pathological myopia ($p<0.05$). **Conclusion:** Around one in ten myopia cases suffers from pathological myopia. Pathological myopia is more common in males especially during adulthood and is associated with poor visual acuity and axial elongation. Another important finding observed in present study was presence of raised intra-ocular pressure among high myopic cases which can be a risk factor for development of optic neuropathy.

Keywords: High Myopia, Keratometry, Myopia, Pathological Myopia, Visual Acuity

1. Introduction

Myopia, commonly referred to as short-sightedness, is a common cause of visual disability throughout the world. The World Health Organization has grouped myopia and uncorrected refractive error with cataract, macular degeneration, infectious disease, and vitamin A deficiency among the leading causes of blindness and vision impairment in the world. People with myopia can be classified in two groups, those with low to modest degrees of myopia (referred to as "simple" or "school" myopia, 0 to −5 dioptres) and those with high or pathological myopia (greater than −5 dioptres)[1].

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The prevalence of myopia varies by the country, age and ethnic group still it is a major cause of visual impairment in the world. The prevalence of myopia has been reported to be as high as 70-90% in some Asian demography. A study from Taiwan reports myopia prevalence of 84% among 16-18 years old students[2].

Irreversible visual impairment and blindness due to high myopia is one of the most serious worldwide vision problems, especially in Asia[3-5]. Holden *et al.*[6] documented that the prevalence of myopia has increased drastically and predicted that by 2050 there would be nearly 1 billion people with high myopia. Moreover, Liu *et al.* estimated that nearly two of every three (65.4%) highly myopic patients develop pathological myopia. Further, visual impairment, with the best-corrected visual acuity (BCVA) worse than 20/60, has been identified in 30.8% of patients with pathological myopia[7].

There is a public health need to prevent the onset or progression of myopia hence ocular risks associated with myopia is to be taken seriously and not to be underestimated. Hence a detailed study was needed to find out the burden of pathological myopia and its associated factors in our set up.

2. Materials and Methods

2.1 Study Design

A hospital based cross sectional study was conducted at Department of Ophthalmology of a Medical College and Hospital/Tertiary care centre. Study included a sample size of 345 with less than 5.0 D spherical equivalent of myopia in both eyes. Written informed consent was obtained from all the patients or patient's relative. Pathological conditions of eye which interferes with vision and patient aged less than 7 years and greater than 40 years were excluded from the study.

Each subject was interviewed, a brief history of the age of onset of defective vision, involvement of other members of the family, the place of residence, and whether the parent's marriage was consanguineous, was recorded. All cases underwent an extensive ophthalmologic screening examination, including measurements of visual acuity and fundus examination by Direct & Indirect Ophthalmoscopy. Data was analysed using SPSS ver. 21.0 using appropriate statistical tests.

3. Results

Prevalence of pathological myopia among myopia cases between 7 to 40 years old was 9% (31 cases out of 345). Among 31 cases of pathological myopia, juvenile and youth onset was seen in 29% cases each while early adult onset was seen in 41.9% cases. Prevalence of pathological myopia was significantly more in females (12.4%) as compared to males (5.7%) (Graph1). Mean age of cases with pathological myopia was significantly more as compared to cases without pathological myopia (26.9 vs

Table 1. Association of best corrected visual acuity and Pathological myopia

BCVA	Pathological Myopia		Pathological Myopia	
	No	Yes	No	Yes
	Right Eye		Left Eye	
6/9	9	0	7	0
	2.9%	0.0%	2.2%	0.0%
6/12 to 6/18	170	4	172	3
	54.1%	12.9%	54.8%	9.7%
6/ 36 to 6/60	135	18	133	20
	43.0%	58.1%	42.4%	64.5%
<6/60	2	9	2	8
	0.6%	29.0%	0.6%	25.8%
Total	314	31	314	31
	100.0%	100.0%	100.0%	100.0%

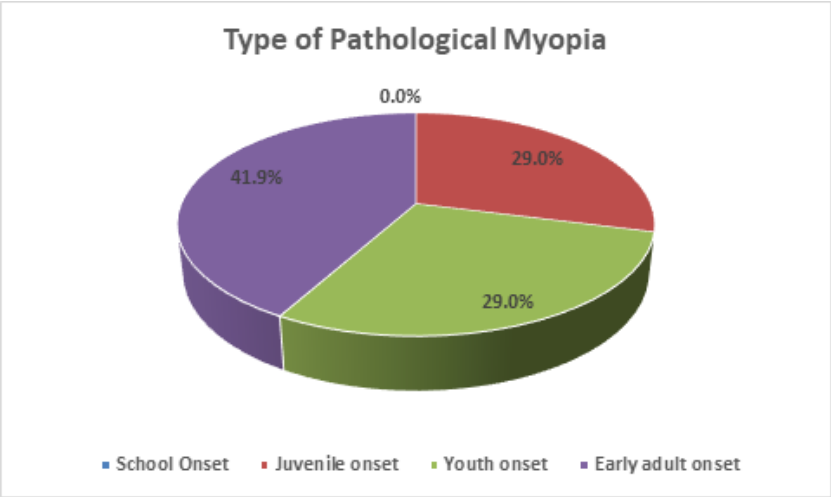

Figure 1. Prevalence of various types of Myopia in study cases

Table 2. Association of various ophthalmic parameters and Pathological myopia in right eye

Ophthalmic Parameters (Right Eye)	Pathological Myopia	N	Mean	SD	p- value
Spherical Error	No	314	-1.61	1.76	**<0.01**
	Yes	31	-5.27	4.90	
Cylindrical Error	No	314	-0.75	0.51	**<0.01**
	Yes	31	-1.22	0.62	
Axis Error	No	314	76.60	39.13	**0.496**
	Yes	31	81.90	49.45	
K1 (Keratometric reading for flat meridian)	No	314	42.94	0.94	**0.617**
	Yes	31	42.85	1.36	
K2 (Keratometric reading for steep meridian)	No	314	42.77	0.93	**0.307**
	Yes	31	42.96	1.42	
IOP (Intraocular pressure)	No	314	14.61	1.41	**<0.01**
	Yes	31	15.82	1.01	
Axis Length	No	314	24.35	0.85	**<0.01**
	Yes	31	25.92	2.16	

23.98 years; p-0.039). Low visual acuity was significantly associated with pathological myopia (p<0.01) (Table 1). Mean spherical and cylindrical error was significantly more in cases with pathological myopia (p<0.01). No difference was observed in keratometry findings among cases with and without pathological myopia (p>0.05).

Table 3. Association of various ophthalmic parameters and Pathological myopia in left eye

Ophthalmic Parameters (Right Eye)	Pathological Myopia	N	Mean	SD	p- value
Spherical Error	No	314	-1.54	2.00	**<0.01**
	Yes	31	-4.48	4.80	
Cylindrical Error	No	314	-0.79	0.51	**0.732**
	Yes	31	-0.83	0.73	
Axis Error	No	314	72.77	38.77	**0.06**
	Yes	31	90.91	41.51	
K1 (Keratometric reading for flat meridian)	No	314	42.74	0.84	**0.906**
	Yes	31	42.72	1.03	
K2 (Keratometric reading for steep meridian)	No	314	42.65	0.87	**0.181**
	Yes	31	42.87	1.23	
IOP (Intraocular pressure)	No	314	15.02	1.42	**0.04**
	Yes	31	15.97	1.14	
Axis Length	No	314	24.32	0.89	**0.028**
	Yes	31	25.77	2.22	

High intra-ocular pressure readings in both eyes were observed in cases with pathological myopia as compared to without it ($p>0.05$). Mean axis length in both right and left eye was significantly more in cases with pathological myopia ($p<0.05$) (Table 2).

4. Discussion

The prevalence of pathological myopia among myopia cases, in the present study, was found to be 9% (31 out of 345 cases). Prevalence studies across the world have indicated that pathological myopia occurs in approximately 12-15% of all myopic population, which corresponds to 2% of the general population[8-10]. Furthermore, a recent review article estimated the prevalence of pathological myopia will increase from 2.7% of the world's population in 2000 to 9.8% by 2050[11].

Pathological myopia has been classified as per age of onset into following categories: Congenital, Childhood, school, juvenile onset, and youth onset, early adult and late adult onset. In present study, we chose subjects between the age ranges of 7 to 40 years. Accordingly, out of the 31 pathological myopia cases, juvenile and youth onset was seen in 29% cases each while early adult onset was seen in 41.9% cases.

Holden BA *et al.*[11] in their study "Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050" also observed high prevalence of early adult onset of pathological myopia. Our results are also in accordance with the findings by Varghese RC *et al.*[12]

and Karabulut S *et al.*[13] where early adult onset formed the predominant group among all pathological myopia cases.

Prevalence of pathological myopia was significantly more in females (12.4%) as compared to males (5.7%). Mean age of cases with pathological myopia was significantly more as compared to cases without pathological myopia (26.9 vs 23.98 years; p-0.039).

Our results are in accordance with other similar studies[13-18]. In a recent study by Saxena R *et al.* on school-going children in North India, the prevalence of HM was found to be 1.5%[1]. Population-based studies show a higher prevalence of PM in women than in men. The Blue Mountains Eye study[17] and Hisayama study[18] reported a prevalence of 0.4% and 2.2% in women, respectively, while in men, it was 0.06% and 1.2%, respectively. Karabulut S *et al.*[13] in a similar study observed that 52.4% of the pathological myopia patients were females while Tano Y *et al.*[14] observed 80% female cases as compared to 20% males.

Mean age in the study by Tano Y *et al.*[14] was 46.9 years which was higher in pathological myopia cases. The mean age in high myopia as observed in the study by Varghese RC *et al.*[12] was 36.28 ± 15.46 years. Karabulut S *et al.*[13] in their study observed that mean age is higher among high myopics (54.1 years). Fujiwara T *et al.*[19] in their study reported that pathological myopia is increasingly common in late adult age and it progressively worsens with age.

Low visual acuity was significantly associated with pathological myopia (p<0.01). A total of 29% (right eye) and 25.8% (left eye) cases had vision on <6/60 in cases of pathological myopia as compared to 0.6% in non-pathological myopia cases. Mean spherical (in both eyes) and cylindrical error (in right eye) was significantly more in cases with pathological myopia (p<0.01).

The above findings are in line with the pathology of high myopia which is associated with an elongated eye and its definition which corresponds to myopia of greater than 6.00 D. The joint report of the WHO on "the impact of myopia and high myopia" defines high myopia as spherical equivalent where the amount of myopia is more than 5D[20-21].

Glaucoma, one of the leading causes of irreversible blindness in the adult population worldwide, is a progressive optic neuropathy. Primary open angle glaucoma (POAG) is the most commonly reported type of glaucoma in population based prevalence studies worldwide. Elevated intraocular pressure is a well-known major risk factor for POAG. Epidemiologic evidence suggests that high myopia is a risk factor for the development and the progression of glaucomatous optic neuropathy[22]. Joseph DS *et al.*[23] in their study observed statistically significant correlation (p<0.05) between IOP and myopia, in moderate and high myopia groups. The IOP was higher in those groups than in emmetropia and low myopia thereby increasing the risk of glaucoma in these patients. In present study too, we observed high intra-ocular pressure readings in both eyes in cases with pathological myopia as compared to without it (p>0.05).

It is not very clear why myopia causes an increased Intraocular pressure. There are several hypotheses. One hypothesis is that the increased intraocular pressure is related to an increased stress of the global wall and decreased ocular rigidity in the myopic eyes[24].

Pathologic or degenerative myopia is defined as the presence of structural changes due to axial elongation in eyes with high myopia[25]. Pathological changes in high myopes start in childhood and become prominent in adulthood. The mechanism behind pathological axial elongation includes an emmetropization process and involves a structural alteration of the collagen proteins[26]. Myopia-related complications such as posterior staphyloma and chorioretinal atrophy increase proportionally with increase in axial length[27].

In present study too, we observed that mean axis length in both right and left eye was significantly more in cases with pathological myopia (p<0.05). However no difference was observed between pathological and non-pathological myopia group regarding measurements of corneal curvature.

5. Conclusion

In our study every one in ten myopia cases suffers from pathological myopia. Pathological myopia is more common in males especially during adulthood and is associated with poor visual acuity and axial elongation. Another important finding observed in present study was presence of raised intra-ocular pressure among high myopic cases which can be a risk factor for development of optic neuropathy. We thus recommend detailed evaluation of all the myopia cases to identify cases with

pathological myopia so that prompt management can be undertaken, thereby preventing development of various vision-threatening conditions.

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