International Journal of Community Medicine and Public Health
Mittal S et al. Int J Community Med Public Health. 2016 May;3(5):1189-1194
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20161382

Research Article

Clinical profile of refractive errors in children in a tertiary care hospital of Northern India

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Received: 02 March 2016
Accepted: 06 April 2016

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ABSTRACT

Background: Refractive errors constitute a major portion of children with visual impairment. Aim of this study was to study the pattern of refractive errors and its association with selected variables (age, sex, educational status, socioeconomic status, amblyopia and strabismus).
Methods: This was hospital based observation descriptive study. The study was conducted on 781 eyes of 396 children, 5-15 years of age attending the ophthalmology OPD of a tertiary care teaching hospital of North India. Interpretation and analysis of obtained results was carried out using SPSS version 22 and non-parametric tests like Pearson Chi-square test was used.
Results: Mean age of presentation was 10.90±3.16 years with male: female ratio of 1.8:1. 57.07% mothers and 70.20% fathers were intermediate and above. Number of children from lower middle socioeconomic status (40.90%) and with a positive family history of refractive errors (59.59%) was higher. 7.07% children had amblyopia and 6.06% children had strabismus. Most of the children with refractive errors were having mild (≤1.5D) refractive error (61.20%) and not using spectacles previously (78.30%). Astigmatism was found in 46.99% followed by myopia (41.23%) and hypermetropia (11.78%). The UCVA was >6/12 in 48.27% eyes.
Conclusions: This study reinforces the previously reported pattern of refractive errors and its association with others variables except that a large number of children were found to have refractive errors but not using spectacles in this area. Risk of refractive error in children was associated with higher level of education of mother which has not been reported earlier.

Keywords: Refractive errors, Astigmatism, Myopia, Hypermetropia

INTRODUCTION

Refractive error is defined as a state in which the optical system of a non-accommodating eye fails to bring the parallel rays of light to focus on the retina.[1] It is of three types - myopia, hypermetropia and astigmatism.[2] Refractive error, as a cause of blindness, is a significant problem both in the developing as well as the developed countries.[3] Hence, refractive errors are one of the priority areas for Vision 2020, a global initiative for the elimination of avoidable blindness introduced by W.H.O.(World Health organization).[4]

The impact of refractive errors on the individual and on the community cannot be ignored. Hence there is a need to plan future strategies and implement appropriate measures for early diagnosis and treatment of refractive errors. Keeping this in mind, the proposed study was conducted to determine the clinical profile of refractive errors in the children of Uttarakhand region.

METHODS

The study was conducted in the Ophthalmology department of tertiary care teaching hospital of North India. 396 children with refractive errors were recruited.Children, 5-15 years of age, diagnosed as having refractive error of 0.50 Dioptres or more and whose parents/guardians gave consent for examination were included in the study. Uncooperative children and those with dense media opacities or history of any intraocular surgery were excluded from the study. Demographic indices including age, sex, address and socio-economic status were recorded. Relevant personal and family history was taken. Unaided visual acuity of all children was measured with the help of Snellen chart.

On the basis of unaided visual acuity, visual impairment was graded as mild (VA 6/6 to 6/12), moderate (VA 6/18 to 6/36) and severe (VA 6/60 to less than 6/60).Pinhole vision was also taken in eyes with visual acuity worse than 6/6. Hirschberg test was done in all cases. Extra-ocular movement, cover test and pupillary reaction were assessed in all cases. All children underwent slit lamp evaluation and fundoscopy. Cycloplegic refraction was carried out followed by post mydriatic test (PMT).

Refractive errors were classified according to the standard definitions as myopia, hypermetropia and astigmatism. Socio-economic status grading was done according to modified B.G. Prasad classification and Kuppuswamy's socio-economic scale. Prior approval of institutional ethics committee was taken. Interpretation and analysis of obtained results was carried out using SPSS version 22 for descriptive statistics. Non parametric tests like Pearson Chi-square test were used to express the qualitative data. Data with value less than 0.05 was considered statistically significant.

RESULTS

A total of 396 children were enrolled for the study out of which 11 children had unilateral refractive error. Hence 781 eyes of 396 children were studied. Out of the total 396 children, 215 (54.30%) were male and 181(45.70%) were female, with male: female ratio of 1.18:1. In the present study the average age of presentation of children with refractive error was 10.90±3.16 years.

This study demonstrated that 134 (33.84%) mothers and 185 (46.72%) fathers were graduate and above. A total of 226 (57.07%) mothers and 278 (70.20%) fathers were intermediate and above (Table 1). Higher education of parents (both father and mother) was associated with presence of refractive error in child and this was statistically significant ($p<0.05$).

Table 1: Distribution of children with refractive errors on the basis of educational status of parents (n=396).

Education	Mother	Father
Illiterate	32 (8.08%)	12 (3.03%)
Primary	71 (17.92%)	29 (7.32%)
High school	67 (16.92%)	77 (19.45%)
Intermediate	92 (23.24%)	93 (23.48%)
Graduate and above	134 (33.84%)	185 (46.72%)
Total	396 (100%)	396 (100%)
p value	$\chi_{(10)}^2$=21.82;p= 0.021	$\chi_{(10)}^2$=35.58;p=0.001

In the present study, 45 (11.36%) of the children belonged to families of upper class, 50 (12.36%) belonged to upper middle class families, 162 (40.90%) to lower middle class, 117 (29.55%) to upper lower class and 22 (5.56%) children belonged to lower class. Majority of children, both male and female, belonged to lower middle class families.

Table 2: Distribution of children with refractive errors on the basis of family history of refractive errors (n=396).

F/H/O refractive error	Male	Female	Total
Present	130 (60.46%)	106 (58.56%)	236 (59.59%)
Absent	85 (39.54%)	75 (41.44%)	160 (41.51%)
Total	215 (54.30%)	181 (45.70%)	396 (100%)

$\chi_{(1)}^2$= 14.586; p=0.000

Table 3: Distribution of eyes on the basis of presenting visual acuity (n=781).

Visual acuity	RE	LE	Total
6/6 to 6/12	191 (50.66%)	186 (49.44%)	377 (48.27%)
6/18 to 6/36	127 (48.10%)	137 (51.90%)	264 (33.80%)
6/60 to less than 6/60	72 (51.42%)	68 (48.58%)	140 (17.93%)
Total	390 (49.93%)	391 (50.07%)	781 (100%)

In the present study, 236(59.59%) children were found to have a positive family history of refractive errors (Table 2). Association of refractive error with positive family history of refractive error was significant (p<0.05). Out of 396 children with refractive error 28(7.07%) children had amblyopia. Out of total 28 children with amblyopia, anisometropic amblyopia was present in 17(60.71%) children with refractive errors. Strabismic amblyopia was present in 11 (39.29%) children.

Table 4. Distribution of types of refractive error by the eye involved (n=781)

Type of refractive error	RE	LE	Total
Myopia	160 (49.68%)	162 (50.32%)	322 (41.23%)
Hypermetropia	49 (53.26%)	43 (46.74%)	92 (11.78%)
Astigmatism	181 (49.31%)	186 (50.69%)	367 (46.99%)
Total	390 (49.93%)	391 (50.07%)	781 (100%)

Out of 396 children with refractive error 24(6.06%) children had strabismus. Esotropia was the most common type of strabismus in children with refractive errors, accounting for 62.50%. Exotropia was present in 37.50% children. In present study, out of 396 children only 86(21.70%) children were already using spectacles, of which 40(46.50%) were males and 46 (53.50%) were females. However majority of children (78.30%) with refractive errors were not using spectacles previously.

Table 5: Distribution of types of refractive error by severity (n=781).

Type of refractive error	Mild (≤1.5D)	Moderate (1.75-2.75D)	Severe (3.0-5.0D)	Very Severe (>5.0D)	Total
Myopia	147 (45.65%)	89 (27.63%)	71 (22.07%)	15 (4.65%)	322 (41.23%)
Hypermetropia	55 (59.78%)	8 (8.69%)	20 (21.75%)	9 (9.78%)	92 (11.78%)
Astigmatism	276 (75.20%)	62 (16.89%)	27 (7.37%)	2 (0.54%)	367 (46.99%)
Total	478 (61.20%)	159 (20.35%)	118 (15.13%)	26 (3.32%)	781 (100%)

Visual acuity at the time of presentation was better than 6/12 in 48.27% of eyes, 6/18 to 6/36 in 33.80% and ≤6/60 in 17.93% of the eyes (Table 3). Hence, most of the children had mild to moderate visual impairment in the present study. In the current study the most common type of refractive error was astigmatism (46.99%), followed by myopia (41.23%) and hypermetropia (11.78%) (Table4). Simple myopic astigmatism was the commonest type of astigmatism, accounting for 56.14% of eyes.

Most of the children suffered from mild to moderate degree of refractive error in all categories (Table 5). Overall 61.20% children were having mild (≤1.5D) refractive error whereas only 3.32% children were having very severe refractive error of more than 5D.

In children 5-10 years of age, 96(29.81%) eyes were myopic while in 11-15 years age group 226(70.19%) were myopic. Hypermetropia was present in 56(60.86%) eyes of children in the age group of 5-10 years while 36(39.14%) eyes of children in the age group of 11-15 years had hypermetropia. Astigmatism was present in 177(48.23%) eyes of children in the age group 5-10 years and 190(51.77%) eyes of children in the age group of 11-15 years.

An age related shift of refractive error was observed from hypermetropia in younger age group towards myopia in the older age group. This relationship of refractive error with age was statistically significant (p≤0.05).

DISCUSSION

Till date, most of the studies done to analyze the pattern of refractive errors in children are either school screening or population based and require huge economic resources. The present study being a hospital based study is unique as it has been conducted in the OPD premises without the need of extra manpower and equipment's.

In the present study, 54.29% of the children were males and 45.70% were females. The prevalence of refractive errors was slightly higher in males as compared to females, though this difference was not statistically significant. Comparable result was reported in a hospital based study done by Rai S et al in Nepal, where 58% children were male.[1] Other hospital based studies done by

Sethi MJ et al in Pakistan, Matta S et al in New Delhi also gave similar result.[4,5]

In a population based study done by Dulani N et al in Jaipur, Rajasthan female preponderance was seen.[6] Other population based studies done by Pavithra MB et al in Bangalore and Prema N et al in Tamil Nadu also reported that females are more affected by refractive errors, which is not comparable with the present study.[7,8] This shows that in hospital based studies like the present study, a male preponderance was observed. On the contrary population based studies showed a female preponderance. The reason for this difference is not clear, but the possible cause of this difference may be ignorance towards the needs of female child or may be due to the social stigma associated with spectacle usage in females.

In the present study the average age of presentation was 10.90±3.16 years. Comparable results were reported by Kalikivayi V et al in Hyderabad, where the average age of presentation was found to be 9.3±3.4 years.[9] Yamamah GA et al in Egypt reported almost similar results. Pavithra MB et al in Bangalore and Hashemi H et al in Iran reported a higher mean age of presentation.[7,10,11] But in all of the above mentioned studies, the minimum age of children included in these studies was also higher.

In the present study, the risk of refractive error in children was associated with higher level of education of parents (both mother and father) and this association was found to be statistically significant.

The association of refractive error, specifically myopia with the father's schooling was also found in rural India and the new Delhi survey.[12,13] Although these studies did not consider the effect of mother's educational status on refractive state of children.

This can be explained by the fact that children from families led by parents with higher levels of educational attainment may experience more emphasis on studies, entail near work, which in turn could cause early detection of refractive error.

Majority of children with refractive errors in this study belonged to lower middle class families (40.90%). In comparison to this Rohul J et al reported higher prevalence of refractive errors in children of upper class families in Kashmir.[14] But this association was not significant in either study.

In the present study family history of refractive error was present in 59.59% children. The association between family history of refractive error in parents or siblings was significant in the present study as well as study done by Pavithra MB et al.[7] Ali A et al also supported this finding. [15] This indicates a relationship between refractive errors and heredity.

In the current study out of 396 children with refractive error 28 (7.07%) children were found to have amblyopia. In a study done by Pant BP et al in Nepal 7.62% children with refractive error were found to have amblyopia.[2] This was similar to the result obtained in this study. Hence, this reinforces the need to look for amblyopia in all the children presenting with refractive errors.

In this study out of 396 children with refractive error 24 (6.06%) children had strabismus. A study done by Kalikivayi V et al in Southern India demonstrated that 13.3% children with refractive errors had strabismus, but the association of strabismus with refractive errors was not found to be significant.[9] This difference may be due to different inclusion criteria.

The present study demonstrated that out of 396 children only 86 (21.70%) children were already using spectacles. There was no significant difference between male and females using spectacles. In the study done by Rai S et al 57% children with refractive errors were using spectacles at initial presentation.[1] Similarly 66.67% were already using glasses in study done by Dulani N et al.[6]A possible reason for this difference may be lack of awareness or shyness to wearing spectacles in this area. Therefore, counseling of children and parents is of equal importance as that of diagnosing refractive errors and prescribing glasses.

In the present study the uncorrected visual acuity in one or both eyes at the time of presentation was better than 6/12 in 48.27% eyes, 6/18 to 6/36 in 33.80% eyes and less than or equal to 6/60 in 17.93% eyes. Similar results were obtained by Sethi MJ et al in Pakistan.[4] Hence, majority of children with refractive error present with mild to moderate decrease in visual acuity (≤6/36).

In present study the prevalence of myopia was 41.23%, hypermetropia 11.78% and astigmatism 46.99%. Astigmatism was the most common type of refractive error in the present study. Similar results were reported from Nepal, Ethiopia and Egypt. [1,10,16] Many studies done in several countries throughout the world including India reported myopia as the most common refractive error.[2,12] Use of different inclusion criteria can be one reason for such difference. In studies done by Kalikivayi V et al in southern India and Mamudi E et al in Macedonia, hypermetropia was the most common refractive error.[9, 17] But in these studies the study population comprised of children starting from 3 years of age. This explains the higher incidence of hypermetropia in these studies.

In present study astigmatism and myopia was much more common than hypermetropia. This can be explained by the fact that all children were school going and many of them sought ophthalmologist's advice for difficulty to see the blackboard in the classroom. Hypermetropic children can accommodate to see clearly while it is not possible in case of myopia and astigmatism.

In the current study most of the children suffered from mild to moderate degree of refractive error in all categories. Myopia up to 2.75D and hypermetropia as well as astigmatism up to 1.5 D was present in majority of the eyes. This finding was in agreement with studies by Hashemi H et al, Krishnamurthy H et al and Shrestha GS et al.[11,18,19]

When association of type of refractive errors with age was studied, an age related shift from hypermetropia in young children to myopia in older children was found. Murthy et al also found that there was an age related shift in refractive error from hypermetropia in young children towards myopia in older children.[15] Kalkivayi V et al in Hyderabad also reported that myopia was significantly higher among children of more than 10 years of age.[9] Similar age related shift from hypermetropia to myopia was noted in other national and international studies.[20, 21]

In the present study age did not significantly affect the prevalence of astigmatism, similar to the results obtained by Pi LH et al.[20]

CONCLUSION

In summary, the average age of presentation of refractive errors in children was 10.90±3.16 years. A positive family history and higher education of parents was significantly associated with the presence of refractive error in child. Majority of children with refractive errors belonged to lower middle class families. Amblyopia and strabismus were also noted in few children with refractive errors.

Most of the children with refractive error present with mild to moderate decrease in visual acuity (≤6/36). Astigmatism was the most common type of refractive error followed by myopia and hypermetropia. Most of the children suffered from mild to moderate degree of refractive error in all categories. An age related shift from hypermetropia in younger age group to myopia in older age group was found. No significant association was found between age of children and the prevalence of astigmatism.

ACKNOWLEDGEMENTS

Authors would extremely like to thank optometry staff for their help and co-operation.

Funding: Financial support for the study was provided by Swami Rama Himalayan University
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mittal S, Maitreya A, Dhasmana R. Clinical profile of refractive errors in children in a tertiary care hospital of Northern India. Int J Community Med Public Health 2016;3:1189-94.