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ORIGINAL ARTICLE

Clinical Profile of Refractive Errors in School-going Children of Bareilly, Uttar Pradesh, India

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ABSTRACT

Introduction: Refractive error is one of the important causes of impaired visual acuity in children.

Aim: To study the pattern of refractive errors in children of Bareilly city and determine its association with selected variables of age, sex, educational status, socioeconomic status, residing locality, family history, previous use of spectacles, amblyopia, and strabismus.

Materials and methods: A cross-sectional study was conducted on 521 children aged 5 to 15 years attending the ophthalmology outpatient department (OPD) of a teaching hospital of Bareilly. Visual status along with dry and cycloplegic refraction was carried out. Relevant data in relation to the selected variables were compiled. Statistical analysis of obtained results was carried out using the software Statistical Package for the Social Sciences (SPSS) version 22.

Results: The mean age of presentation of refractive error was 10.75 ± 2.96 years with a distinct male preponderance and with a male:female ratio of 1.33:1. Parental education background revealed fair literacy rate with 56.23% mothers and 69.28% fathers having intermediate qualification and above. Higher incidence of refractive error was noted in children with upper lower socioeconomic status (34.54%) and with those having positive family history (61.23%); 7.67% children were amblyopic and 7.10% children had coexisting strabismus. Most of the children (80.23%) gave no history of previous use of spectacles. Astigmatism was noted as the commonest refractive error in 45.09% followed by myopia (42.86%) and hypermetropia (12.05%).

Conclusion: The study provides an insight into the quantum, extent, and form of visual impairment prevalent in Bareilly district. It furnishes essential data for planning and evaluating preventive and curative services for visual impairment of children in this region.

Clinical significance: These data support the assumption that vision screening of achool children in developing countries would be very useful in early detection of correctable causes of poor vision, especially refractive errors and in preventingvisual complications.

Keywords: Refractive errors, School-going children.

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INTRODUCTION

Refractive error is one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness.[1]

The significance of early detection of refractive errors in childhood springs from the fact that this condition is largely avoidable with a cost-effective treatment.[2] Screening activity is essential since children do not complain of defective vision, and at times may be unaware of their problem. It is noteworthy that poor vision during childhood and adolescence affects academic and overall school performance and may have a negative influence on the future life. Available data on the type of refractive errors in developing countries are scarce. It shows interregional disparities based on geography, urban rural background, and ethnicity.

Keeping these factors in view, the present study was undertaken to determine the prevalence of refractive errors in children of Bareilly district.

MATERIALS AND METHODS

This study was done on school-going children aged 5 to 15 years, attending the ophthalmology OPD of a tertiary care center in Bareilly city. A prior informed consent was taken from the parents of participating children. A detailed history was taken about the present and past ocular problems along with the history of use of spectacles. Both unaided and aided visual acuity were recorded using Snellen's chart. Postmydriatic refraction was done after 1 week of cycloplegic retinoscopy and appropriate spectacles were prescribed to the children as per the protocol. Spherical equivalent (SE) was used for calculations of refractive error. The SE was derived by adding the spherical component of refraction to half of the cylindrical component. Myopia was defined as an SE of at least −0.5 D and hyperopia as that of +2.00 D or more. Astigmatic students were labelled with a cylindrical refractive power of 0.75 D or more in at least one eye. Anisometropia was defined as a difference in SE of at least 1.0 D between the two eyes. Data were analyzed using SPSS, version 22 software program. Percentage and 95% CI were used to describe the prevalence of

refractive errors. Spearman chi-squared test was applied for qualitative data. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 521 children were studied over a period of 1 year. Out of these, 13 children had unilateral refractive error, hence 1,029 eyes with refractive errors of the 521 children were taken into account. Out of these, 57.2% were boys. A total of 235 children (45.11%) were in the age range of 5 to 10 years and the remaining 286 (54.89%) were 11 to 15 years. In the present study, the average age of presentation of children with refractive error was 10.75 ± 2.96 years.

It was observed that 298 (57.20%) were from urban areas, while 223 (42.80%) children were from rural areas (Table 1).

This study demonstrated that 293 (56.23%) mothers and 361 (69.28%) fathers were having educational qualification of intermediate and above (Table 2).

It was observed that visual acuity at the time of presentation was better than 6/12 in 46.55% of eyes, 6/18 to 6/36 in 34.49% of eyes, and ≤6/60 in 18.95% of the eyes. Hence, most of the children had mild-to-moderate visual impairment.

In terms of socioeconomic status, 68 (13%) of the children belonged to families of upper class, 71 (13.63%) belonged to upper middle class, 159 (30.51%) to lower middle class, 180 (34.54%) to upper lower class, and only 43 (8.25%) children belonged to lower class families. Hence, majority of children, both male and female, were noted to come from upper lower-class families.

In the present study, 319 (61.23%) children were found to have a positive family history of refractive errors with 202 (38.77%) children reported no such history. Association of refractive errors was hence not seen to be significantly associated with a positive family history ($p > 0.05$) (Table 3).

In this study, 40 (7.67%) children were detected to have amblyopia, out of which anisometropic amblyopia was present in 24 (60%) and strabismic amblyopia in 16 (40%) children.

Out of these 521 children, 37 (7.10%) children had strabismus. Esotropia was the most common type of strabismus in children with refractive errors, accounting for 64.70%, while exotropia was present in 35.30% children.

In our study, only 103 (19.77%) children were already using spectacles, of which 58 (56.31%) were males and 45 (43.69%) were females. However, majority of the children (80.23%) with refractive errors were not using spectacles previously. There was no significant difference between males and females using spectacles (Table 4).

In the current study, the most common type of refractive error was astigmatism (45.09%), followed by myopia (42.86%) and hypermetropia (12.05%). No association between the type of refractive error and laterality of eye was noted. An age-related shift was observed from hypermetropia with a higher incidence in younger age group to myopia and astigmatism with a higher incidence in older age group (Table 5).

Table 1: Distribution of children with refractive errors based on rural–urban background (n = 521)

Area	*Male*	*Female*	*Total*
Urban	167 (56.05%)	131 (43.95%)	298 (57.20%)
Rural	131 (58.75%)	92 (41.25%)	223 (42.80%)
Total	298 (57.20%)	223 (42.80%)	521 (100%)

$\chi_{(2)}^2 = 2.769$; p = 0.5914

Table 2: Distribution of children with refractive errors based on educational status of parents (n = 521)

Education	*Mother*	*Father*
Illiterate	49 (9.40%)	22 (4.22%)
Primary	95 (18.23%)	35 (6.74%)
High school	84 (16.13%)	103 (19.76%)
Intermediate	128 (24.57%)	131 (25.14%)
Graduate and above	165 (31.67%)	230 (44.14%)
Total	521 (100%)	521 (100%)

$\chi_{(10)}^2 = 21.82$; p = 1.00

Table 3: Distribution of children with refractive errors based on family history of refractive errors (n = 521)

Family history of refractive error	*Male*	*Female*	*Total*
Present	179 (60.06%)	140 (62.78%)	319 (61.23%)
Absent	119 (39.93%)	83 (37.22%)	202 (38.77%)
Total	298 (57.2%)	223 (42.80%)	521 (100%)

$\chi_{(1)}^2 = 14.586$; p = 0.5857

Table 4: Distribution of children with refractive errors based on history of previous use of spectacles (n = 521)

H/O previous use of spectacles	*Male*	*Female*	*Total*
Present	58 (56.31%)	45 (43.69%)	103 (19.77%)
Absent	240 (57.42%)	178 (42.58%)	418 (80.23%)
Total	298 (57.30%)	223 (42.70%)	521 (100%)

$\chi_{(2)}^2 = 3.876$; p = 0.4458

Table 5: Distribution of types of refractive error by age (n = 1029)

Type of refractive error	*5–10 years*	*11–15 years*	*Total*
Myopia	203 (46.03%)	238 (53.96%)	441 (42.86%)
Hypermetropia	63 (50.81%)	61 (49.19%)	124 (12.05%)
Astigmatism	203 (43.75%)	261 (56.25%)	464 (45.09%)
Total	469 (45.57%)	560 (54.43%)	1029 (100%)

$\chi_{(2)}^2 = 15.353$; p = 0.7190

DISCUSSION

Childhood blindness due to uncorrected refractive error has emerged as a major public health problem, the cognizance of which has been taken by the World Health Organization in its Vision 2020 program. Worldwide, uncorrected refractive error accounts for up to 42% of visual impairment and equally affects both developing and developed nations.[3] Interregional disparities in the nature, demography, and type of refractive error have been reported by various studies. A close analysis of these is particularly useful in educating scientific world and public for effective management of the condition.

The present study has been designed as a cross-sectional hospital-based descriptive study on school-aged children falling in the age group of 5 to 15 years hailing largely from the Bareilly district of northern India.

Of the 521 assessed children during the study period of 1 year, the mean age of presentation was noted to be 10.75 ± 2.96 years (5–15 years). This was comparable with reports of 9.3 ± 3.4, 9.7 ± 3.3, and 10.7 ± 3.1 years by Kalikivayi et al[4] in Hyderabad, Wu et al[5] in China, and Yamamah et al[6] in Egypt respectively. The age of presentation of refractive error assumes large significance, since it determines the prognosis of permanent visual disabilities like amblyopia, strabismus and has a bearing on the intellect and overall psychological development of the child.

The gender distribution of refractive errors in our study revealed a higher preponderance of males, with 298 (57.20%) male and 223 (42.80%) female participants. This difference was, however, not statistically significant ($p > 0.05$). A hospital-based study by Rai et al[7] in Nepal reported similar results with 58% male affliction. Comparable results were reported for other hospital-based studies done by Alam and Fareed[8] and Sethi et al[9] in Pakistan, Matta et al[10] in New Delhi, and Rohul et al[11] in Kashmir.

In our study, myopia was noted in 42.86% of children while astigmatism and hypermetropia in were noted in 45.09 and 12.05% of patients respectively. This is in agreement with the study done by Sethi et al[12] in Pakistan and similar studies in Nepal,[7] Ethiopia,[13] and Egypt,[14] all of which designated astigmatism as the most common type of refractive error followed by myopia and hypermetropia.

The association of refractive error with hereditary factors has been acknowledged by most studies. Our study noted a parental or sibling background of refractive error in 61.23% of patients. It was not significant in our study, but Pavithra et al[15] found a very strong relationship between refractive errors and hereditary or familial factors. Ali et al[16] also reported that a positive family history of myopia is related to progression of myopia and refractive error.

The prevalence of refractive error was found to be high in the urban area (57.20%) as compared with rural areas (42.80%), similar to the findings of Pavithra et al[15] in Bengaluru, Batra et al[17] in Punjab, and Padhye et al[2] in Maharashtra. Comparatively lower rates of refractive error are seen in rural areas where children do not face the same emphasis on schooling and are frequently withdrawn from school at an early age, whereas the children of urban areas have better access to educational services which make the children more prone for near work compared with rural children.

It was seen that parents (both mother and father) with higher levels of education were more likely to have children with refractive errors. Similar results of association between educational background and refractive errors in children were observed in the New Delhi survey.[18] Although these studies did not consider the effect of mother's educational status on the refractive state of child, it was found significant in our study.

Refractive error is one of the few ailments that equally affect the affluent and the poor, the developing and the developed world. Socioeconomic status seems to be an indicator determining the type and degree of refractive error. Contemporary studies have documented a high association of myopia and other refractive error with high socioeconomic background and better schooling access. Our study noted a high association of refractive error with middle-income background with more than 60% affected children coming from either lower middle or upper lower class (refer Kuppuswamy classification for urban and BJ Prasad's classification for rural economic stratification).

In the present study, only 103 out of 521 children with refractive errors were using spectacles (19.77%). The percentage of such children was notably much higher (57%) in a similar study done in Nepal.[7] The reported differences highlight the indifference of parents to the need of wearing spectacles by needy children of the area. A possible reason could be a social stigma with glasses especially for girls, lack of facilities of spectacle provisioning, or simply the irresponsible attitude toward children at large. Counseling of parents and societal awareness are therefore of equal importance as that of diagnosing refractive errors and prescribing glasses in this scenario.

A total of 40 (7.67%) children were found to have amblyopia. Similar results were seen in the studies done by Pant et al[19] in Nepal, and Sethi et al[12] in which 7.62 and 6.95% children were amblyopic respectively. Amblyopia treatment is most effective when done early in a child's life, usually before the age of 7 years.[15] This reinforces the need to screen for amblyopia in all children presenting with refractive error.

In this study, out of 521 children who were studied, 37 (7.10%) were found strabismic. A study done by

Kalikivayi et al[4] 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. A higher prevalence was noted in Pakistan by Sethi et al,[12] where 20% of children with refractive errors had strabismus. This difference may partly be due to the inclusion of much younger age group in the study.

Present-day studies investigating refractive errors in children are essentially population-based surveys. They employ identical protocols as outlined by the refractive error survey in children employing cluster sampling. To that extent, our study carries the handicap of a hospital-based study confined to eye OPD of a tertiary hospital. This provided the data with a distinct urban bias, since majority of rural children failed to report particularly with milder degrees of visual impairment. Despite these limitations, the study provided an insight into the quantum, extent, and form of visual impairment prevalent in Bareilly district. It furnishes essential data for planning and evaluating preventive and curative services for visual impairment of children in this region.

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 a 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.

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