Burden of Ocular Motility Disorders at a Tertiary Care Institution: A Case to Enhance Secondary Level Eye Care

Rohit Saxena¹, Digvijay Singh¹², Shiva Prasad Gantyala¹, Sneha Aggarwal¹, Murli Manohar Sachdeva¹, Pradeep Sharma¹

¹Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, ²Division of Ophthalmology, Medanta-The Medicity, Gurgaon, Haryana, India

ABSTRACT

Aim: To evaluate the profile of strabismus and amblyopia in patients presenting to a tertiary care institution in order to understand the disease burden. Materials and Methods: A retrospective, prospective hospital-based observational study was conducted at a tertiary level eye care hospital in India. All patients with strabismus or amblyopia who presented over a 1-year period were identified and referred to the squint clinic, where they were evaluated with a detailed clinical history and examination. Results: A total of 24475 patients were evaluated, of which 1950 had strabismus or amblyopia. The overall magnitude of amblyopia and strabismus was 2.0% [95% confidence interval (CI), 1.8-2.2] and 6.9% (95% CI, 6.6-7.2), respectively. About 20% of those seeking an ophthalmic consultation were children and they constituted over half of the population referred to the squint clinic. Among younger children, the burden of amblyopia and strabismus was 84.4% and 26.6%, respectively. Among the referred patients, strabismus was noted in 84.6% (N = 1649), most of the cases of which was of the comitant subtype (78.1%, N = 1288) with an equal distribution of exotropia and esotropia. Paralytic [12.9% (N = 251)] and restrictive [4.7% (N = 85)] squint constituted the remaining burden of strabismus. Conclusion: Strabismus and amblyopia affect a sizeable proportion of patients presenting to a tertiary care ophthalmology setup. A significantly higher burden is present in the pediatric population. The majority of the cases of strabismus are of a comitant variety, which do not merit tertiary level eye care. There is a need to improve pediatric eye care at a secondary level to reduce the immense burden on tertiary referral centers.

Keywords: Amblyopia, esotropia, exotropia, ophthalmology, pediatric, strabismus

Introduction

Strabismus (squint) and amblyopia are not infrequent causes of ocular morbidity in India. Both typically affect children in the early years and subsequently result in vision loss and impaired binocular function.(¹) While these have not been disorders under the spotlight of India’s national program for control of blindness, they have been given due attention in the recent thrust on pediatric ophthalmology in the Vision 2020 initiative.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Access this article online

Quick Response Code:

Website:
www.ijcm.org.in

DOI:
10.4103/0970-0218.177523

Address for correspondence:
Dr. Rohit Saxena, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, Room No. 377, New Delhi, India.
E-mail: rohitsaxena80@yahoo.com

Received: 12-06-15, Accepted: 16-11-2015
While the literature abounds in studies discussing the prevalence of amblyopia and strabismus, both globally and in India, there are few hospital-based studies that provide the complete clinicodemographic profile of amblyopia and strabismus, including their subtypes. The current study evaluates all patients who visited a tertiary care center, in an attempt to better define the clinical and demographic pattern of strabismus across all ages in the Indian scenario while aiming to highlight the immense load of this condition on a tertiary level eye care center.

Materials and Methods

A prospective, retrospective hospital-based observational study was conducted at a tertiary level eye care center in India after prior approval from the institution’s Ethics Committee. All patients presenting to the ophthalmic outpatient department over a 1-year period (February 1, 2012 to January 31, 2013) underwent a screening examination for ocular motility or related disorders. The protocol for examination for all patients who were evaluated at the general outpatient clinic included a visual acuity assessment, cover test, ocular motility examination, slit lamp examination, and fundus examination. If on initial examination there was a suspicion of amblyopia or strabismus, the patients were referred to the squint and amblyopia clinic. At the clinic, the patients underwent a detailed evaluation by an expert ophthalmologist. The clinic workup included recording a detailed clinical history including age of onset, duration of symptoms, progression of symptoms, and previous treatment taken, along with a comprehensive eye examination. The examination included monocular distance visual acuity, evaluation of ocular motility and alignment, anterior segment examination, and fundus evaluation. Age-appropriate cycloplegic refraction was done to assess the refractive status of the eyes. The cycloplegia of choice for assessing refractive status was atropine 1% ointment for children aged ≤5 years and homatropine 2% eyedrops for subjects aged above 5 years.

Strabismus or squint was defined as the presence of misalignment between the visual axis of the eyes (as evidenced by a cover test) presenting with deviation of the eyes. Strabismus was further subdivided into comitant (if the amount of misalignment between the eyes due to squint remained equal in all directions of gaze) and incomitant (if the amount of misalignment between the eyes due to squint varied in different directions of gaze). If the squinting eye was deviated inward, it was termed as a convergent squint or esotropia and if the squinting eye was deviated outward, it was termed as a divergent squint or exotropia. Nystagmus was defined as the presence of involuntary wiggly or dancing eye movements. Amblyopia was defined as reduced vision in either or both eyes in the absence of an organic cause. Amblyopia was classified as anisometropic if there was a significant difference between the refractive error of the two eyes, or strabismic if the amblyopia was caused due to squint.

Unilateral amblyopia was diagnosed on the basis of difference in best corrected visual acuity of two lines or more between the two eyes in the absence of any organic cause and best corrected visual acuity in the worse eye being <20/30. Any predisposing factor such as anisometropia or strabismus was noted. Bilateral amblyopia was defined as bilateral decreased best corrected visual acuity <20/30 (or equivalent) in the presence of bilateral isometropia (hyperopia ≥4.00 D, myopia ≥6.00 D, astigmatism ≥2.50 D).

Ocular alignment was evaluated using unilateral cover (cover-uncover) test, simultaneous prism and cover test at 6 m (with 20/30 optotype of the Snellen chart for fixation) and at 40 cm (with near N9 target for fixation), with and without optical correction. For measurement of squint, the prism bar cover test was applied in patients with both eye vision ≥20/30 having central fixation; the Krimsky test was used in patients with low vision in one eye (<20/200); and the Hirschberg test was used in young children, patients with bilateral poor vision, or uncooperative patients. Strabismus was further classified as manifest or latent squint. Manifest strabismus was further divided into comitant (labeled as esotropia or exotropia) and incomitant (labeled as paralytic or restrictive squint). Manifest horizontal strabismus was also classified as intermittent and constant. The presence of nystagmus was noted, as was its association with squint or amblyopia.

Statistical analysis was done using Stata 11.0 (StataCorp LP, College Station, Texas, USA). The proportion was estimated by dividing the number of individuals with any type of strabismus or any form of amblyopia by the total number of individuals recruited. Exact binomial confidence intervals (CIs) were calculated for the proportion estimates. The results were reported as proportion (95% CIs). Descriptive statistics were used to depict the subclassification of strabismus and amblyopia.

Results

A total of 24475 patients visited the eye hospital during the year for recruitment in the study and were considered the study population. Of these, 1950 patients were diagnosed to have either squint or amblyopia and were referred to the squint and amblyopia clinic [Table 1]. Mean age of these 1950 patients was 16.1 ± 14 years. Around one in four
Table 1: Demographic and clinical profile of study subjects

| Parameters       | Overall (N = 24475) | Squint clinic referrals (N = 1950) |
|------------------|----------------------|-----------------------------------|
|                  | Number (%)           | Number/Population (Percentage; 95% CI) |
| Age              |                      |                                   |
| <12 years        | 4805 (19.6)          | 1204/4805 (25%; 23.8-26.3)        |
| ≥12 years        | 19670 (80.4)         | 926/19670 (4.7%; 4.4-5.0)         |
| Sex (among ≥12 years; N=19670) |                      |                                   |
| Male             | 12971 (52.9)         | 632/12971 (4.8%; 4.5-5.2)         |
| Female           | 6699 (27.3)          | 294/6699 (4.3%; 3.9-4.9)          |
| Strabismus       |                      |                                   |
| All              | 1649 (6)             | 1649/24475 (78.1%; 76.0-80.0)     |
| Comitant         | 1288 (5.0)           | 1288/1649 (78.1%; 76.0-80.0)      |
| Incomitant       | 361 (1.4)            | 361/1649 (21.8%; 19.9-23.9)       |
| Esotropia (Comitant) |                  |                                   |
| Intermittent     | 8 (0.03)             | 8/598 (1.3%; 0.5-2.6)             |
| Constant         | 590 (2.4)            | 590/598 (19.6%; 97.3-99.4)        |
| Exotropia (Comitant) |                  |                                   |
| Intermittent     | 184 (0.7)            | 184/587 (31.3%; 27.6-35.2)        |
| Constant         | 403 (2)              | 403/587 (68.7%; 64.9-71.5)        |
| Incomitant       | 276 (1.1)            | 276/361 (76.4%; 71.7-80.7)        |
| Paralytic        | 85 (0.3)             | 85/361 (23.6%; 19.2-28.2)         |
| Restrictive      |                      |                                   |
| Strabismus magnitude (Distance) (N = 1649) |                  |                                   |
| 1-9 PD           |                      | 905                                |
| 10-30 PD         |                      | 471 (28.6%; 26.4-30.9)            |
| >30 PD           |                      | 273                                |
| Strabismus magnitude (Near) (N = 1649) |                  |                                   |
| 1-9 PD           |                      | 880                                |
| 10-30 PD         |                      | 440                                |
| >30 PD           |                      | 329                                |
| Amblyopia        |                      |                                   |
| All              | 494 (2)              | 494/494 (64.7%; 60.3-68.9)        |
| Anisometropic    | 174 (0.7)            | (2.0%; 1.8-2.2)                    |
| Strabismic       | 320 (1)              | 320/494 (64.7%; 60.3-68.9)        |
| Nystagmus        | 224 (0.9%)           |                                   |

Overall, the magnitude of strabismus was found to be 6.9% [95% confidence interval (CI), 6.6-7.2%], with that in children (age <12 years) being higher, at 14.8% (95% CI, 6.6-15.7%). Of the total number of referred cases, 84.6% (N = 1649) had squint, of which over three-fourth were of the comitant subtype. Of the comitant squints, 103 cases had a significant difference between up gaze and down gaze measurements and were classified separately as pattern strabismus. For the remaining 1185, there was an equal distribution of exotropia and esotropia. Among all squints, paralytic squints constituted 14.2% (N = 276), while restrictive squint constituted 4.3% (N = 85). Of the patients unaccounted for in the strabismus or amblyopia groups, 5.9% (N = 111) had phorias, 1% had vertical squints (N = 20), and 2.9% (N = 57) were wrong referrals.

Strabismic amblyopia was the most common type of amblyopia noted in the study and was nearly equally distributed among esotropia and exotropia. Of the children (aged 6 years and below) who visited the eye hospital, 84.4% and 26.6% had amblyopia and strabismus, respectively.

Nystagmus was noted in 11.5% (N = 224). Nystagmus was associated with comitant strabismus in 7% (N = 136), with amblyopia in 3% (N = 61) and with incomitant squint in 0.6% (N = 11). The table describes in detail the magnitude of strabismus and amblyopia and includes subgroup analysis.

**Discussion**

The study examined the clinical and demographic profile of patients visiting the outpatient department and squint clinic of a tertiary level eye care institution in India.

Amblyopia was found in over 2% of the patients seeking an eye consultation. This value is similar to the general prevalence rates of amblyopia described in the literature, which vary 0.2-5.3%, with slightly higher figures in India.[2-4] While it appears not to form an important reason for patients to visit a tertiary care eye hospital, it has been estimated to be the cause for 12.3% of cases of severe visual impairment in India.[5-7] The scenario changes in the pediatric subgroup, where, of the nearly 5,000 children aged 12 years and below, over 60% had amblyopia, while in the age group of 6 years and below, nearly 85% suffered from amblyopia. This is significantly more than that observed in the general pediatric population, where the prevalence of amblyopia in these age groups hovers around 1%.[8-14] This a clear indicator of the funneling of pediatric cases to a tertiary care center due to the lack of pediatric eye care facilities at a primary or even secondary level. There are no similar hospital-based studies; therefore a comparison has been made with population-based

children from the total population suffered from either strabismus or amblyopia and were referred to the squint clinic as against 4.7% of the adults. Among the adults, the male-to-female ratio in the main population was 2:1, with an equitable proportion of adult males and females being referred from the total population. Ocular motility-related morbidity was noted in 4.8% of the males and 4.3% of the females who visited the hospital outpatient department.
studies while recognizing the potential Berkesonian bias. The most common type of amblyopia in the current study was strabismic, which has been documented in the literature previously, including in one previous hospital-based study by the authors. In contrast, however, various other studies quote anisometropic amblyopia to be the commoner cause. There was no category of mixed amblyopia included in our study, and cases of amblyopia having both anisometropic and strabismic components were classified under strabismic amblyopia. The difference in the type of amblyopia observed in population-based studies and hospital-based studies may be explained by the fact that a large number of anisometropic amblyopes in the population may not be seeking consultation at a tertiary level hospital, either due to unawareness of their amblyopia or because they are undergoing management at a secondary level institution. In contrast, amblyopia associated with strabismus is probably more evident and causes the patient to visit a tertiary level hospital. Amblyopia can be easily managed at primary or secondary level clinics and does not routinely require a tertiary level referral. The prolonged follow-up required for amblyopia therapy and the risk of long-term recurrence mandate repeated visits to a tertiary care center, which implies a financial burden to the patient’s family. Therefore, developing decentralized pediatric and ophthalmic health care would go a long way in managing diseases such as amblyopia, which have a simple treatment process.

The magnitude of squints among all patients seeking an ophthalmology consultation at our institution was 6% and that for children was 26.6%. While there are no previous hospital-based studies that may be compared, population-based surveys among children demonstrate a wide range of prevalence of strabismus varying from 0.29% to 5%. This again indicates the excessive referral of pediatric strabismus to a tertiary care institution due to lack of adequate facilities for management at a primary or secondary level. Further, the fact that the large majority of squints seen in the study were comitant squints with a predominant horizontal misalignment, which can easily be managed by a nonspecialist ophthalmologist, only reiterates the need for better infrastructure and skill training at the secondary health care institutions. Such a process would enable tertiary institutions to manage the more complicated cases requiring specialists’ intervention. The need for developing more pediatric ophthalmology setups and training ophthalmologists for handling such cases in developing countries including India is further emphasized by the fact that children account for over half (52.5%) of the total patients seen in our squint and amblyopia clinic.

The clinical profile of strabismus demonstrated an equal distribution of esotropia and exotropia. Hospital-based literature from around the globe differs from this in showing a higher proportion of esotropia than exotropia. However, these hospital-based studies have only evaluated surgical cases, unlike our study, which evaluated patients with all forms of squint. The majority of the population-based studies in the literature that were conducted among the general population, specifically in the pediatric age group, have demonstrated a higher proportion of esotropia in comparison to exotropia. However, the Baltimore Pediatric Eye Disease Study (BPEDS) showed a nearly equal distribution of esotropia and exotropia. In our study, comitant squints were more commonly associated with younger patients, while incomitant squints occurred predominantly in the older patients. The probable explanation is that the older age group has more risk factors for paralytic squints and restrictive strabismus, including diabetes, hypertension, and thyroid disease, while children have a higher prevalence of refractive and accommodative squints. While the trend is understandable, it has not been categorically documented previously in the literature.

The exact magnitude of nystagmus is still unknown due to paucity of studies. Previous hospital-based data have found a magnitude of 0.24% as against the higher proportion of 0.9% seen in our study. It is possible that the scarcity of specialized ophthalmic services at the secondary level have led to a higher referral rate to a tertiary care hospital in India, as evidenced by the relatively higher proportion seen.

A limitation that merits mention is that a significant portion of the study was retrospective and the occasional incomplete or missing records could potentially add errors to the magnitudes reported.

The study has revealed a definite heavy burden of ocular motility morbidity at a tertiary care center. There is a significant financial and socioeconomic burden on society for developing and managing tertiary health care infrastructures, and on individuals for obtaining treatment at such institutions. This has been highlighted in various reports and holds true with regard to the ocular motility disorder burden, too. There is a need to manage these cases at secondary level centers and establish proper referral systems so that health care services at tertiary centers are not overburdened.

**Conclusion**

In conclusion, while defining the clinical and demographic characteristics of patients with strabismus or amblyopia...
attending the outpatient department of a tertiary level eye care center, the study sheds light on the fairly heavy pediatric referral and emphasizes the need for better pediatric ophthalmology management at a secondary care level in the country.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References
1. Menon V, Chaudhuri Z, Saxena R, Gill K, Sachdev MM. Profile of amblyopia in hospital referral practice. Indian J Ophthalmol 2005;53:227-34.

2. Multi-ethnic Pediatric Eye Disease Study Group. Prevalence of amblyopia and strabismus in African American and Hispanic children ages 6 to 72 months: The Multi-ethnic pediatric eye disease study. Ophthalmology 2008;115:1229-36.e1.

3. Dandona L, Dandona R, Srinivas M, Giridhar P, Vilas K, Prasad MN, et al. Blindness in the Indian state of Andhra Pradesh. Invest Ophthalmol Vis Sci 2001;42:908-16.

4. Kalikiyavi V, Naduvilath TJ, Bansal AK, Dandona L. Visual impairment in school children in southern India. Indian J Ophthalmol 1997;45:129-34.

5. Rahi JS, Sripathi S, Gilbert CE, Foster A. Childhood blindness in India: Causes in 1318 blind school students in nine states. Eye (Lond) 1995;9:545-50.

6. Menon V, Chaudhuri Z, Saxena R, Gill K, Sachdeva MM. Factors influencing visual rehabilitation after occlusion therapy in unilateral amblyopia in children. Indian J Med Res 2005;122:497-505.

7. Pediatric Eye Disease Investigator Group. The clinical profile of moderate amblyopia in children younger than 7 years. Arch Ophthalmol 2002;120:281-7.

8. Barry JC, König HH. Test characteristics of orthoptic screening examination in 3 year old kindergarten children. Br J Ophthalmol 2003;87:909-16.

9. Hashemi H, Yekta A, Jafarzadehpur E, Niroozad F, Ostadimoghaddam H, Eshrat B, et al. The prevalence of amblyopia in 7-year-old schoolchildren in Iran. Strabismus 2014;22:152-7.

10. Lithander J. Prevalence of amblyopia with anisometropia or strabismus among schoolchildren in the Sultanate of Oman. Acta Ophthalmol Scand 1998;76:658-62.

11. Fu J, Li SM, Li SY, Li JL, Li H, Zhu BD, et al. Prevalence, causes and associations of amblyopia in year 1 students in Central China: The Anyang childhood eye study (ACES). Graefes Arch Clin Exp Ophthalmol 2014;252:137-43.

12. Fu J, Li SM, Liu LR, Li JL, Li SY, Zhu BD, et al.; Anyang Childhood Eye Study Group. Prevalence of amblyopia and strabismus in a population of 7th-grade junior high school students in Central China: The Anyang Childhood Eye Study (ACES). Ophthalmic Epidemiol 2014;21:197-203.

13. Ganekal S, Jhanji V, Liang Y, Dorairaj S. Prevalence and etiology of amblyopia in Southern India: Results from screening of school children aged 5-15 years. Ophthalmic Epidemiol 2013;20:228-31.

14. Pi LH, Chen L, Liu Q, Ke N, Fang J, Zhang S, et al. Prevalence of eye diseases and causes of visual impairment in school-aged children in Western China. J Epidemiol 2012;22:37-44.

15. Saxena R, Puranik S, Singh D, Menon V, Sharma P, Phuiljhele S. Factors predicting recurrence in successfully treated cases of anisometric amblyopia. Indian J Ophthalmol 2013;61:630-3.

16. Govindan M, Mohney BG, Diehl NN, Burke JP. Incidence and types of childhood exotropia: A population-based study. Ophthalmology 2005;112:104-8.

17. Greenberg AE, Mohney BG, Diehl NN, Burke JP. Incidence and types of childhood exotropia. Ophthalmology 2007;114:170-4.

18. Friedman DS, Repka MX, Katz J, Giordano L, Ibironke J, Hawse P, et al. Prevalence of amblyopia and strabismus in white and African American children aged 6 through 71 months the Baltimore Pediatric Eye Disease Study. Ophthalmology 2009;116:2128-34.e1-2.

19. Chia A, Dirani M, Chan YH, Gazzard G, Au Eong KG, Selvaraj P, et al. Prevalence of amblyopia and strabismus in young Singaporean Chinese children. Invest Ophthalmol Vis Sci 2010;51:3411-7.

20. Kac MJ, Freitas Junior MB, Kac SI, Andrade EP. Frequency of ocular deviations at the strabismus sector of the Hospital do Servidor Público Estadual de São Paulo. Arq Bras Oftalmol 2007;70:939-42.

21. Curtis TH, McClatchey M, Wheeler DT. Epidemiology of surgical strabismus in Saudi Arabia. Ophthalmic Epidemiol 2010;17:307-14.

22. Azonobi IR, Olutunji FO, Addo J. Prevalence and pattern of strabismus in Ilorin. West Afr J Med 2009;18:633-6.

23. Idrees Z, Dooley I, Fahy G. Horizontal strabismus surgical outcomes in a teaching hospital. Ir Med J 2014;107:176-8.

24. Sarvananthan N, Surendran M, Roberts EO, Jain S, Thomas S, Dwivedi CA, et al. Prevalence of nystagmus in 3 year old kindergarten children. Br J Ophthalmol 2002;86:540-4.

25. Report of the Working Group on Tertiary Care Institutions for 12th Five Year Plan (2012-2017). Available from: http://planningcommission.nic.in/aboutus/committee/wrkgp12/health/WG_2tertiary.pdf. [Last accessed on 2015 Nov 4].

26. Singh MM, Devi R. Operationalizing an effective referral system in India. BMJ 2015;351:h5489.