

Clinical pattern and burden of strabismus in a teaching institute of Northeast India

Tanie Natung, Oinam S. Devi, Lanalyn Thangkhiew, Subhankar Paul

Department of Ophthalmology, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), Shillong, Meghalaya, India

ABSTRACT

Purpose: To determine the clinical pattern and burden of strabismus in a teaching institute of Northeast (NE) India. **Methods:** In this hospital-based, cross-sectional study, detailed clinical evaluation of patients with manifest strabismus was carried out for a period of one and half years. **Results:** Out of the 7222 new outpatient department attendances, a total of 110 new patients with manifest strabismus were found, with a hospital-based burden of 1.52% [95% confidence interval: 1.3–1.8]. Comitant strabismus was seen in 84.55%, and incomitant in 15.45%. Exotropia comprised 70%, esotropia 26.36%, hypertropia 10%, and hypotropia 2.72%. The angle of deviation was large in most of the participants (69.09%) with a mean of 34.90 ± 17.08 PD for horizontal and 13.29 ± 8.97 PD for vertical deviations. A cause of strabismus could be identified in 30.91%. Paralytic strabismus was seen in 15.45%, sensory in 11.82%, infantile in 1.82%, and accommodative in 1.82%. Amblyopia was found in 5.45%. In our study, 25.45% patients underwent strabismus surgery, while 74.55% patients either needed conservative management or were being worked up for surgery till the end of this study. **Conclusion:** This study determined the pattern and burden of strabismus in a teaching institute of NE India. Since the institute caters to patients from different states of NE India, this study gives an indirect picture of the burden of strabismus of the whole of NE India. It is hoped that these data will aid in determining the overall burden of strabismus in the country. They will also help the family medicine and primary care physicians to have an idea about the burden and pattern of strabismus in the community, thus enabling them to create awareness about strabismus, remove the undue apprehensions of patients, and do timely referrals for treatment and prevent irreversible visual loss.

Keywords: Amblyopia, burden of strabismus, esotropia, exotropia, ophthalmology, pattern of strabismus

Introduction

It is important to know the burden of a disease and its pattern to get an idea of its magnitude in a given area. A meta-analysis of various studies across the world on strabismus showed an estimated pooled prevalence of 1.93%.^[1] In this meta-analysis, the prevalence of exotropia (1.23%) was higher than esotropia (0.77%). This analysis revealed that the

distribution and pattern of strabismus are heterogeneous in different parts of the world and within the same region of the world.

There is paucity of studies on the prevalence of strabismus in India. To our knowledge, there is no study to suggest the overall prevalence of strabismus in India till date. However, there are some studies from certain regions of the country. In North India, the overall magnitude of strabismus was found to be 6.9% in a hospital-based study.^[2] A similar hospital-based study in South India estimated the strabismus prevalence to be 7.8 per thousand patients (0.78%).^[3] The Kariapatti Paediatric Eye Evaluation project carried out in South India showed the community prevalence of strabismus to be 0.43%.^[4] Studies

Address for correspondence: Dr. Oinam S. Devi, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), P.O. Mawdiangdiang, Shillong - 793 018, Meghalaya, India.
E-mail: somapikaoinam@gmail.com

Received: 13-06-2024

Revised: 18-07-2024

Accepted: 25-07-2024

Published: 09-12-2024

Access this article online

Quick Response Code:



Website:
<http://journals.lww.com/JFMPC>

DOI:
10.4103/jfmpe.jfmpe_1032_24

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Natung T, Devi OS, Thangkhiew L, Paul S. Clinical pattern and burden of strabismus in a teaching institute of Northeast India. J Family Med Prim Care 2024;13:5739-44.

from western India and central India found the prevalence to be 4.95% and 0.2%, respectively.^[5] All these studies show that the prevalence or burden of strabismus is different in different parts of India, ranging from 0.43% to 6.9%. However, to the best of our knowledge, there are no such data available from the Northeast (NE) India, which is a land of ethnically highly varied population. Moreover, many of the patients with strabismus present late to the ophthalmologists, which can lead to amblyopia, since the patients and even primary care physicians at times are unaware of the problems and the need for early treatment of these conditions. Proper knowledge and timely referral of such patients can prevent the chance of irreversible visual loss in these patients.

Therefore, the objective of our study was to determine the clinical pattern and burden of strabismus in patients presenting to a teaching institute of NE India. As this institute caters to patients from all the states of the region, it will give an indirect picture of the whole of NE India. These data, in turn, may aid in estimating the overall burden of strabismus of our country. They may also help in guiding the healthcare planners to take the necessary steps for awareness, screening, and curative services. It is also expected to help the family medicine and primary care physicians to have an idea about the burden and pattern of strabismus and amblyopia in the community. With the knowledge thus gained, they can create awareness and alleviate their patients' undue fears about strabismus and its treatment, thus enabling them to do timely referrals for further treatment and prevent the chance of irreversible visual loss.

Materials and Methods

A hospital-based, cross-sectional study was conducted in the Department of Ophthalmology of a relatively new teaching institute of NE India from May 1, 2021 to October 31, 2022. Patients of all age groups with only manifest strabismus were included in the study. Patients with phorias and patients on follow-ups were excluded. The study was approved by the Scientific Advisory Committee and the Institute Ethics Committee.

A detailed clinical history relevant to strabismus was taken, visual acuity was checked, and refraction with appropriate cycloplegia for the age was done. Extraocular movements in the nine diagnostic gazes were noted. Hirschberg corneal reflex test was done to see the rough estimate of the amount of deviation. Prism bar cover test (PBCT) was done to find the amount of deviation in prism diopters (PD). For patients with poor vision in one eye, Krimsky test was done to determine the amount of deviation. Stereopsis was tested using the Synoptophore. Clinical photos of patients in nine diagnostic gazes were taken for documentation, which was meant for the purpose of record keeping only. Diplopia charting and Hess charting, wherever applicable, were plotted. Blood investigations and magnetic resonance imaging (MRI)/X-ray orbits, wherever applicable, were done.

Amblyopia was defined as reduction of best corrected visual acuity (BCVA) in one or both eyes due to form visual deprivation and/or abnormal binocular interaction without any structural abnormality of the eye or the visual system. It was considered as present if there was an interocular difference in BCVA of 2 (two) lines or more or if the BCVA was worse than 6/9.

Categorical variables were expressed as percentages, whereas continuous variables were expressed as mean \pm standard deviation. The data collected were recorded in Microsoft Excel 2022, and statistical analysis was done using the *SPSS for Windows, version 22.0, SPSS Inc., IBM Corp., Chicago, IL USA, IBM Corp.*

The hospital-based burden of strabismus was calculated by dividing the total number of new patients with manifest strabismus by the total number of new patients registering in the outpatient department (OPD) of ophthalmology during the same time period.

Results

Out of the 27,293 registrations in the ophthalmology OPD between May 1, 2021 and October 31, 2022, there were 7222 new ophthalmology patients. Among these new patients, 110 patients were found to have manifest strabismus, and therefore, the burden of strabismus was found to be 1.52% (95% CI: 1.3–1.8). The demographic profile and pattern of strabismus are given in Table 1. The subclassification of esotropia and exotropia is given in Table 2. The types of strabismus which could not be classified strictly into one distinct type of strabismus by history and/or examination or which were of mixed possibilities of either one or more types were classified into 'Unclassified' subgroups in this table. The mean age of the participants was 27.16 ± 15.71 years (range: 2–68 years). The majority of the patients (43.63%) were in the age group of 20 to 39 years. Males outnumbered females in our study, comprising 55.45% and 45.55%, respectively. The mean age of onset of strabismus was 12.96 years; the mean age of presentation was 27.16 years, and the mean duration of delay in presentation was 14.22 years.

Comitant strabismus was more common than the incomitant type. The percentage of comitant strabismus was 84.55%, while that of incomitant strabismus was 15.45%. Exotropia was the most common deviation (70%), followed by esotropia (26.36%), hypertropia (10%), and hypotropia (2.72%). It was noted that horizontal deviations were frequently coexisting with vertical deviations. There were a few cases of dissociated vertical deviations associated with infantile esotropia, infantile exotropia, and sensory tropias. Since these were present as associations, these are not shown as separate entities in Tables 1 and 2. The mean angle of horizontal deviation was 34.90 PD for far and 33.47 PD for near, whereas it was 13.29 PD for the vertical deviations. The majority of cases were idiopathic (69.09%). Among the identifiable causes, the paralytic cause was 15.45%, sensory 11.82%, and accommodative 1.82%. Superior oblique

Table 1: Demographic profile and clinical pattern of strabismus

Parameters	Mean±SD/ Percentage (numbers)	Range
Mean Age (years)	27.16±15.71	2-68
Age group (years)	32.73 (36)	
0-19	43.64 (48)	
20-39	18.18 (20)	
40-59≥60	5.45 (6)	
Sex		
Male	55.45 (61)	
Female	45.55 (49)	
Burden	1.52 (95% CI: 1.3-1.8)	
Types of strabismus		
Comitant	84.55 (93)	
Incomitant	15.45 (17)	
Types of Exotropia		
Comitant		
Constant	36.67 (33)	
IDS	15.56 (14)	
Incomitant		
Paralytic	8.89 (8)	
Restrictive	0	
Types of Esotropia		
Accommodative	6.89 (2)	
Non-accommodative	93.10 (27)	
Hypertropia	10 (11)	
Hypotropia	2.72 (3)	
Mean angle of deviation (PD)		
Horizontal (far)	34.90±17.08	6-85
Horizontal (near)	33.47±16.65	3-90
Vertical	13.29±8.97	3-30
Causes		
Sensory	11.82 (13)	
Paralytic	15.45 (17)	
Infantile	1.82 (2)	
Accommodative	1.82 (2)	
Others	69.09 (76)	
Refractive Error		
Myopia	23.64 (26)	
Hyperopia	14.55 (16)	
Others	61.82 (68)	
Stereopsis		
Intact grossly	87.27 (96)	
Not Intact	8.1 (9)	
Could not be tested	4.5 (5)	
Amblyopia	5.45 (6)	
Anisometropic amblyopia	3.63 (4)	
Strabismic Amblyopia	1.82 (2)	
Treatment		
Conservative	74.55 (82)	
Surgery	25.45 (28)	

SD=Standard Deviation, IDS=Intermittent Divergent Squint, PD=Prism Diopter

palsy (CN IV) was seen in three cases, third nerve (CN III) palsy in seven cases, and lateral rectus palsy (CN VI) in six cases. Inferior oblique overaction was seen in 25 cases. During the study period, 11 numbers of V pattern, 2 numbers of A pattern, 1 number of X pattern, and 1 number of Y pattern were seen. During the same period, we did not encounter any case of restrictive pathologies like Duane’s retraction syndrome, Brown syndrome, thyroid ophthalmopathy causing restrictive

Table 2: Subclassification of esotropia and exotropia

Subtypes	Percentage (numbers)
Esotropia	
Comitant	
Accommodative	
Refractive	6.89 (2)
Nonrefractive	0 (0)
Partially Accommodative	0 (0)
Non-accommodative	
Essential Infantile	3.45 (1)
Essential acquired/Late onset	20.68 (6)
Sensory	10.34 (3)
Acute acquired concomitant	3.45 (1)
Consecutive	0 (0)
Cyclic	0 (0)
Microtropia	0 (0)
Nystagmus blockage syndrome	0 (0)
Incomitant	
Paralytic	31.03 (9)
Restrictive	0 (0)
Spastic	0 (0)
Unclassified/Mixed type*	24.13 (7)
Exotropia	
Comitant	
IDS	18.18 (14)
Constant	42.88 (33)
Essential Infantile	1.29 (1)
Sensory	12.98 (10)
Consecutive	0 (0)
Incomitant	
Paralytic - acquired	10.38 (8)
Congenital	0 (0)
Restrictive	0 (0)
Unclassified/Mixed type*	14.28 (11)

*The types of strabismus which could not be classified strictly into one distinct type of strabismus by history and/or examination or which were of mixed possibilities of either one or two types were classified into ‘Unclassified’ subgroups

strabismus, congenital fibrosis of extraocular muscles, chronic progressive external ophthalmoplegia, and so on.

In our study, refractive errors were found in 38.18% of the patients, myopia contributing to 23.64% and hyperopia 14.55%. Among the exotropes, myopia was seen in 24% (18) of the patients, and among the esotropes, hypermetropia was seen in 31.03% (9) of the patients.

Amblyopia was seen in 5.45% of the patients, of which 1.82% was strabismic amblyopia, while the remaining 3.63% was anisometropic amblyopia.

Out of the 110 new patients, 28 underwent surgical corrections during the study period, while the remaining 82 were managed conservatively or were being worked up for surgical corrections till the end of this study. Among the subset managed conservatively, 15 of them needed surgical corrections, but they opted not to undergo the procedure due to apprehension and other reasons.

Discussion

This study profiled the clinical pattern and burden of strabismus presenting to a relatively new teaching institute in NE India. There is lack of studies on strabismus prevalence across the country, especially where all age groups are included. The burden of strabismus in our hospital-based study was found to be 1.52% (95% CI: 1.3–1.8). Saxena R *et al.*^[2] found the overall magnitude of strabismus to be 6.9% in their hospital-based study. Their overall magnitude is much higher than that of our study as it was conducted in the apex institute of the country, which gets referral from all over the country, whereas ours is a relatively new institute in one of the states in the NE region. Studies on the pediatric population from North India found the prevalence to be 0.27%, western India 4.95%, and central India 0.2%.^[5–7] The worldwide pooled prevalence of strabismus by a meta-analysis was estimated to be 1.93%.^[1] A similar meta-analysis on African studies found the prevalence to be 0.8%.^[8] Studies from China found the prevalence of strabismus to vary from 1.98% to 5%.^[9,10] Studies from Singapore, Ethiopia, and Iran showed a prevalence of 0.80%, 17.9%, and 2.02%, respectively.^[11–13] A study in USA showed the strabismus prevalence to be 3.3% in white children and 2.1% in African American children.^[14] All these studies suggest that the prevalence of strabismus has a wide range.

In our study, the percentage of comitant strabismus was 84.55% and that of incomitant strabismus was 15.45%. Saxena R *et al.*^[2] found in their study the comitant subtype to be 78.1% and incomitant to be 21.9%. We see that the percentages of comitant and incomitant strabismus in our study are nearly similar to their findings.

Exotropia was the most common strabismus (70.0%) in our study, followed by esotropia (26.36%), hypertropia (10.0%), and hypotropia (2.72%). Saxena R *et al.*^[2] found similar percentages of exotropia and esotropia, 45.5% and 46.4%, respectively. Sarosh *et al.*^[15] found esotropia (59.93%) to be more common than exotropia (36.6%). Jing Fu *et al.*^[10] found exotropia to be the most common deviation (94.4%). In our study, among the exotropes, constant exotropia was more common than intermittent divergent squint (IDS), which is in contrast to the existing literature.^[16–18] The frequency of IDS was greater in the age group of 0–19 years (8), followed by 20–39 years (5) and 40–59 (1) years of age.^[1] This supports the natural history of progression of IDS, which becomes constant with time. The IDS being the most common subtype of exotropia in the literature could be attributed to the fact that it becomes constant over time and most of the strabismus studies have been conducted in the pediatric population. Saxena *et al.*^[2] also found constant exotropia to be more common than IDS, which is similar to our study and where the study population was also similar to ours, in which the patients of all age groups were included.

The mean age of the participants in our study was 27.16 ± 15.71 years (range: 2–68 years). Most of the participants were young adults, which implies that the patients in our study

sought medical advice for the treatment of strabismus at a later stage. The majority of participants were in the age range of 20–39 years. In the hospital-based study of Saxena R *et al.*,^[2] the mean age of participants was $16.1 \text{ years} \pm 14 \text{ years}$. Though, they also included participants of all ages; their mean age was lower than that of our study. In the study conducted in western India, the age range was 5–15 years, and in southern India, it was 3–16 years.^[5,19] In the study by Jing Fu *et al.*,^[10] the mean age was 12.4 ± 0.6 years, and Agaje BG *et al.*^[12] found the mean age to be 7.14 ± 4.13 years. Most of the studies on strabismus were done in pediatric populations, and hence, their mean ages were lower than that in our study.

We found a male preponderance in our study. The percentages of male and female participants were 55.45% and 44.55%, respectively. The South Indian study by Attada T R *et al.*^[19] found almost an equal proportion of males and females, 51% and 49%, respectively. The Chinese study by Jing Fu *et al.*^[10] also found similar findings, 50.4% males and 49.6% females.

The mean angle of deviation for horizontal strabismus in our study was large. The mean PBCIT for horizontal deviation for far was 34.90 PD and that for near was 33.47 PD, whereas for the vertical strabismus, it was 13.29 PD. Saxena R *et al.*^[2] found most of the patients to have small angle deviations between 1 and 9 PD, while Sarosh R *et al.*^[15] found the angle of deviation to be between 20 and 40 PD for most of the patients. Tengtrisorn *et al.*,^[20] in their hospital-based study in Thailand, found the angle of deviation to be 47.82 PD for far, though they excluded paralytic, accommodative, and cyclovertical deviations.

Sensory strabismus was found in 11.82% participants in our study, and paralytic strabismus was found in 15.45%. Infantile deviation was found in 1.82%. The accommodative cause was found in 1.82%. The paralytic causes in young were neurovascular conflict, cerebral vasculitis, and CNS infections, whereas space occupying lesions were predominantly seen in the elderly people.

Amblyopia was found in 5.45% (6) of our participants, 3.63% (4) of which were anisometropic amblyopia, while 1.82% (2) were strabismic amblyopia. Indian studies have found the prevalence of amblyopia to vary between 2 and 35.89%.^[2,5,15] The global pooled prevalence of amblyopia was found to be 1.75% in a meta-analysis by Hashemi H *et al.*^[21] In North America, the prevalence was estimated to be 2–4%.^[22] The prevalence of amblyopia was found to be 0.6% in African studies.^[8] In South East Asian studies, it varied from 0.82% to 2.3%.^[9,10] Even though the majority of the literature suggests that strabismic amblyopia is the predominant type of amblyopia, Fu J *et al.*^[10] and Ganekal S *et al.*^[23] also found anisometropic amblyopia to be the more common type of amblyopia. A comparison of some studies on strabismus from India and the World is given in Table 3.

In our study, 25.45% underwent corrective surgeries, while 74.55% of patients either received conservative treatment or were being worked up for surgery till the end of this study.

Table 3: Comparison of some studies on strabismus from India and the World

Study	Place of study	Mean Age (years)/Range (years/months)	Sex (M:F) (%)	Prevalence/burden (%)	Exotropia (%)	Esotropia (%)	Amblyopia (%)	Paralytic Strabismus (%)
Saxena R <i>et al.</i> ^[2]	North India	16.1±14	52.9:27.3	6.9	45.5	46.4	2	14.2
Rajasekaran R <i>et al.</i> ^[5]	South India	-	-	0.78*	57.17	30.94	-	-
Kelkar J <i>et al.</i> ^[5]	West India	5.15±3.32	57.07:42.93 [†]	4.95	-	-	-	-
Singh V <i>et al.</i> ^[6]	North India	5-15	46.94:53.05 [‡]	0.27	-	-	0.41	-
Agrawal D <i>et al.</i> ^[7]	Central India	5-15	44.4:55.6	0.2	-	-	0.4	-
Sarosh <i>et al.</i> ^[15]	North India	-	43.3:56.6	-	36.6	59.93	35.89	-
Attada TR <i>et al.</i> ^[19]	South India	3-10	51:49	0.6	57.6 [§]	40.6 [§]	-	-
Zhu H <i>et al.</i> ^[9]	China	7.7±0.6 13.8±0.7	54.6:55.4 41.5: 48.5	1.98	99	8	0.82	2
Jing Fu <i>et al.</i> ^[10]	China	12.4±0.6	50.4:49.6	5	94.4	1.9	2.3	2.8
Chia <i>et al.</i> ^[11]	Singapore	6-72 months	-	0.80	-	-	1.19	-
Agaje B <i>et al.</i> ^[12]	Ethiopia	7.14±4.13	56.9:43.1	17.9	-	-	16.7	-
Yekta A <i>et al.</i> ^[13]	Iran	12.5	-	2.02	1	0.59	2.29	-
Friedman DS <i>et al.</i> ^[14]	USA	6-71 months	-	3.3 White 2.1 African American	1.8 White 1 African American	1.5 White 1 African American	1.8 Whites 0.8 African American	-
Present Study Natung <i>et al.</i>	North East India	27.16±15.71	55.45:45.55	1.52	70	26.36	5.45	12.72

*Given as prevalence per 1000 OPD patients for the year 2018. †Only percentage of males was given, female percentage deduced. ‡Male and female percentages were deduced, originally given in numbers. §Percentage deduced, originally given in numbers. ||Deduced after combining percentages of intermittent exotropia and constant exotropia

Out of the patients managed conservatively, 18.29% (15) of them were advised surgery, but they opted otherwise. This shows that a few patients were sceptical about undergoing strabismus surgeries due to apprehension and lack of awareness.

We did not find any history of consanguineous marriage in any of our participants owing to the fact that this practice itself is uncommon in most parts of NE India. A positive history of strabismus among siblings and first-degree relatives was seen in three cases. Studies conducted in regions of the world where consanguineous marriage is a common practice show increased prevalence of strabismus. The higher prevalence of strabismus in these populations could be attributed to consanguineous marriage.^[24,25] The study in Kashmir by Sarosh R *et al.*^[15] found that 37.10% of the patients were born out of consanguineous marriages. Attada T *et al.*^[19] in Andhra Pradesh study found history of consanguinity in 22% of cases.

It is worthy to note that most of the previous studies on strabismus were conducted in the pediatric age groups which do not give the true picture of the overall burden of strabismus in the population. Our study included patients of all age groups, which is a true representation of strabismus in the real world.

There were a few limitations in this study. It was conducted in a relatively new teaching institute, the duration of study was short, the sample size was relatively small, phorias were not included in the study, it has calculated only a hospital-based burden of strabismus, and stereopsis was measured only with synoptophore. A large community-based study in the NE region is recommended to get the true picture of the prevalence and pattern of strabismus in this region.

Conclusion

This study throws light on the pattern and burden of strabismus in patients attending a teaching institute of NE India. Since the institute caters to patients from different states of NE India, this study gives an indirect picture of the burden of strabismus of the whole of NE India. It is hoped that this will add to the pool of strabismus data in India and aid in estimating the overall burden of strabismus in the country. It will also help the family medicine and primary care physicians to have an idea about the burden and pattern of strabismus and amblyopia in the community, thus enabling them to create awareness about strabismus and amblyopia, remove the apprehensions of their patients, and do timely referrals for proper treatment and prevent irreversible visual loss.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Hashemi H, Pakzad R, Heydarian S, Yekta A, Aghamirsalim M, Shokrollahzadeh F, *et al.* Global and regional prevalence of strabismus: A comprehensive systematic review and meta-analysis. *Strabismus* 2019;27:54-65.
2. Saxena R, Singh D, Gantyal S, Aggarwal S, Sachdeva MM, Sharma P. Burden of ocular motility disorders at a teaching institution: A case to enhance secondary level eye care. *Indian J Community Med* 2016;41:103-7.
3. Rajasekaran R, Ramesh MK, Balagopal A, Ramesh PV,

- Mohan K. Prevalence of various types of strabismus among patients attending a tertiary eye care hospital at Tiruchirappalli. *J Evol Med Dent Sci* 2018;7:5484-7.
4. Nirmalan PK, Vijayalakshmi P, Sheeladevi S, Kothari MB, Sundaresan K, Rahmathullah L. The Kariapatti Pediatric Eye Evaluation Project: Baseline ophthalmic data of children aged 15 years or younger in Southern India. *Am J Ophthalmol* 2003;136:703-9.
 5. Kelkar J, Kelkar A, Thakur P, Jain HH, Kelkar S. The epidemiology and disease pattern of pediatric ocular morbidities in Western India: The National Institute of Ophthalmology Amblyopia StUdy in Indian Paediatric EyeS (NIMBUS) study report 1. *Indian J Ophthalmol* 2023;71:941-5.
 6. Singh V, Malik KPS, Malik VK, Jain K. Prevalence of ocular morbidity in school going children in West Uttar Pradesh. *Indian J Ophthalmol* 2017;65:500-8.
 7. Agrawal D, Sahu A, Agrawal D. Prevalence of ocular morbidities among school children in Raipur district, India. *Indian J Ophthalmol* 2020;68:340-4.
 8. Akowuah PK, Adade S, Nartey A, Owusu E, Donkor R, Ankamah-Lomotey S, *et al.* Strabismus and amblyopia in Africa - A systematic review and meta-analysis. *Strabismus* 2023;31:31-44.
 9. Zhu H, Pan C, Sun Q, Huang D, Fu Z, Wang J, *et al.* Prevalence of amblyopia and strabismus in Hani school children in rural southwest China: A cross-sectional study. *BMJ Open* 2019;9:e025441.
 10. Fu J, Li SM, Liu LR, Li JL, Li SY, Zhu BD, *et al.* 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.
 11. 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.
 12. Agaje BG, Delelegne D, Abera E, Desta K, Gorum M, Mossie M, *et al.* Strabismus prevalence and associated factors among pediatric patients in southern Ethiopia: A cross-sectional study. *J Int Med Res* 2020;48:30006052096433.
 13. Yekta A, Fotouhi A, Hashemi H, Dehghani C, Ostadimoghaddam H, Heravian J, *et al.* The prevalence of anisometropia, amblyopia and strabismus in school children of Shiraz, Iran. *Strabismus* 2010;18:104-10.
 14. Friedman DS, Repka MX, Katz J, Giordano L, Ibrionke 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.
 15. Sarosh R, Khan A, Rashi O, Hakak B, Nisa A, Sarosh P. Profile of strabismus at a teaching hospital in Kashmir. *Int J Contemp Med Res* 2018;6:F4-7.
 16. Audren F. Les strabismes divergents intermittents [Intermittent exotropia]. *J Fr Ophtalmol* 2019;42:1007-19.
 17. Nelson LB. Clinical characteristics associated with intermittent exotropia that may affect its control. *J Pediatr Ophthalmol Strabismus* 2022;59:4.
 18. Kelkar J, Gopal S, Shah RB, Kelkar AS. Intermittent exotropia: Surgical treatment strategies. *Indian J Ophthalmol* 2015;63:566-9.
 19. Attada T, Deepika M, Laxmi S. Strabismus in paediatric age (3-16 year): A clinical study. *Int J Res Med Sci* 2016;4:1903-9.
 20. Tengtrisorn S, Tungsattayathitthan A, Na Phatthalung S, Singha P, Rattanalert N, Bhurachokviwat S, *et al.* The reliability of the angle of deviation measurement from the Photo-Hirschberg tests and Krimsky tests. *PLoS One* 2021;16:e0258744.
 21. Hashemi H, Pakzad R, Yekta A, Bostamzad P, Aghamirsalim M, Sardari S, *et al.* Global and regional estimates of prevalence of amblyopia: A systematic review and meta-analysis. *Strabismus* 2018;26:168-83.
 22. DeSantis D. Amblyopia. *Pediatr Clin N Am* 2014;61:505-18.
 23. 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.
 24. Bagheri M, Farvardin M, Saadat M. A study of consanguineous marriage as a risk factor for developing comitant strabismus. *J Community Genet* 2015;6:177-80.
 25. Iqbal S, Nadeem HA. Type of horizontal deviation in consanguinity. *Pak J Ophthalmol* 2018;2:103-6.