

Ocular comorbidities in children with strabismus in Benin City

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ABSTRACT

Background: Strabismus is the misalignment of the visual axis. Certain comorbidities have been found to be associated with strabismus. These must be identified and treated. **Objective:** The aim of this study was to determine the ocular comorbidities associated with strabismus in children 15 years and below presenting to the eye clinic of University of Benin Teaching Hospital, Benin City, from January 2014 to December 2014. **Patients and Methods:** This is a prospective hospital-based observational study of consecutive patients seen in the eye clinic. **Results:** Fifty-five children presented with strabismus accounting for 2.6% of the total number of 2112 new cases. There were 30 males (54.5%) and 25 females (45.5%) giving a male-to-female ratio of 1:0.83. The age range was from 5 months to 14 years. The mean age was 4.7 years with a standard deviation of ± 3.4 years. Thirty-seven (67.3%) of the patients were under 5 years of age. Forty-seven (85.5%) patients had esotropia, six (10.9%) had exotropia, and two (3.6%) had hypertropia. Vision-impairing comorbidities included refractive error in 33 (64.7%) patients, cataract in 9 (17.6%) patients, corneal opacity in 1 (2.0%) patient, and retinopathy of prematurity in 1 (2.0%) patient. Nonvision-impairing disorders were microcornea, conjunctivitis, and nasolacrimal duct obstruction. The relationship between ocular comorbidity and types of strabismus was not statistically significant ($P > 0.05$). **Conclusion:** Detailed assessment to identify the comorbidities associated with strabismus is recommended. This could improve the management of this condition.

Keywords: Children, comorbidities, refractive error, strabismus

INTRODUCTION

Strabismus is the misalignment of the visual axis.^[1] The global prevalence of strabismus in the general population has been found to be 3%–5%.^[2] The prevalence of strabismus in the African population is quite low compared to Caucasians or Asian studies. Ayanru reported that strabismus was not common as it was seen in only 1.9/1000 patients in Benin.^[3] Abiose *et al.* found strabismus in only 0.7% of secondary

schoolchildren in Kaduna, Nigeria.^[4] The study in Ilesa local government area reported a prevalence of 0.3% among primary and secondary schoolchildren.^[5] In Anambra state, southeastern Nigeria, among children in three rural communities, a prevalence of 0.4% was observed.^[6] Similar prevalence was found in the studies done in Ibadan and Ilorin.^[7,8] A study on prevalence and pattern of strabismus in primary schools in Benin City, Nigeria, revealed a prevalence of 0.89%.^[9] However, higher prevalence rates have been found in more recent Nigerian studies ranging from 2.2% to 8.8%.^[10-12]

The Multi-Ethnic Pediatric Eye Disease Study, a population-based study conducted among children aged 6–72 months in Los Angeles County, California, reported that strabismus was detected in 2.4% of

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Hispanic/Latino children and 2.5% of African-American children ($P = 0.81$) and was more prevalent in older children than in younger ones.^[13]

Studies from the United Kingdom also conform to the generally accepted prevalence of about 3%–5%. The Avon longitudinal study of Parents and Children study, conducted in Bristol, reported that 2.3% (95% confidence interval 2.0%–2.7%) had manifest strabismus.^[14] In Brazil, of the 1015 elementary and high school students examined, 2.9% had strabismus.^[15]

Various studies have shown strabismus to be associated with other comorbidities such as refractive error (hypermetropia and myopia), nystagmus, cataract, corneal opacity, ocular coloboma, and amblyopia.^[16-20] High ametropia (hypermetropia more than myopia) and anisometropia have been known to favor the development of strabismus.^[16]

The treatment of strabismus typically consists of spectacle correction followed sometimes with orthoptic exercises directed toward improving muscle strength. These exercises have advanced beyond just muscle strengthening to include training and rehabilitation of the eye–brain connection (neuroplasticity) involved in vision in order to maintain ocular alignment. Thereafter, surgery can be done for those with a significant nonaccommodative element.^[21]

Detailed ocular assessment is important in patients with strabismus to enable one identify other ocular conditions that could adversely affect the management outcome. The aim of this study was to evaluate the relationship between strabismus and associated ocular comorbidities such as visual pathway opacity (cataract and corneal opacity), retinopathy of prematurity, and uncorrected high refractive errors such as hypermetropia, myopia, and astigmatism.

PATIENTS AND METHODS

This was a prospective hospital-based observational study of consecutive patients 15 years and below presenting to the eye clinic of the University of Benin Teaching Hospital, Benin City. Ethical approval (ADM/E 22/A/VOL. VII/ 1161) was obtained on March 2nd, 2015 from Ethics and Research Committee, University of Benin Teaching Hospital. All the procedures have been carried out as per the guidelines given in Declaration of Helsinki 2013. Furthermore, consent to enlist

a child was obtained from the parents or caregiver and confidentiality of information was ensured. All children presenting with strabismus from January 2014 to December 2014 were included in the study. A structured questionnaire was used to collect the data. The information obtained included the child's age, gender, religion, level of education, history of deviation of the eyes, and general pediatric history.

Visual acuity was measured at 6 meters with the Tumbling E chart and Snellen chart for the older children, fixation and/or following of light source, resistance to occlusion, recognition of picture charts, and objects for the much younger children. Assessment of the angle of deviation using the corneal light reflex (Hirschberg test) for near and distance as well as the single prism test was done.

Examination of the anterior segment was done using the pen torch and the Carl Zeiss portable slit lamp, and the posterior segment using a Welch Allyn direct ophthalmoscope. Dilated fundus examination with binocular indirect ophthalmoscope and refraction under sedation for the uncooperative child was carried out. Cycloplegic refraction using guttae atropine twice a day for 3 days before the test day was performed.

Data collated were analyzed using the Statistical Package for the Social Sciences 21 (IBM Corp., Armonk, NY, USA). Frequency distribution tables were generated. The ranges and means were determined. The relationship between categorical data was analyzed using Chi-square and Fisher's exact tests. At the adopted confidence level of 95%, a P value of 0.05 (5%) or less was regarded as significant.

RESULTS

A total of 2112 new patients comprising of both adults and children were seen in the eye clinic in the period under review. Fifty-five children presented with strabismus accounting for 2.6% of the total number of new cases. Thirty ($n = 30$) patients were males (54.5%) and 25 females (45.5%) giving a male-to-female ratio of 1:0.83. The age range was from 5 months to 14 years [Table 1]. The mean age was 4.7 years with a standard deviation of ± 3.4 years. Thirty-seven (67.3%) of the patients were under 5 years of age, with majority being 1 year and below. Strabismus was more common in children between 0 and 5 years of age. Esotropia was the most common type in this age group but was

not found to be statistically significant ($P = 0.78$). Forty percent ($n = 22$) of them were preschoolers, 27.3% ($n = 12$) were in nursery school, 29.1% ($n = 16$) were in primary school, and 3.6% ($n = 2$) were secondary school students.

About 51 (92.7%) of this study sample had other associated ocular comorbidities [Table 2]. Vision-impairing comorbidities included corneal opacity in 1 (2.0%) patient, cataract in 9 (17.6%) patients, about 4 of the patients with cataract also had microcornea, retinopathy of prematurity in 1 (2.0%) patient, and refractive error in 33 (64.7%) patients. Nonvision-impairing disorders were microcornea in 4 (7.8%), conjunctivitis in 2 (3.9%), and nasolacrimal duct obstruction in 1 (2.0%) patient. The relationship between ocular comorbidity and types of strabismus was not statistically significant ($P > 0.05$).

Thirty-three out of the 55 (60%) patients had refractive error [Table 3]. It is important to note that more than

half of the patients (28 out of the 33 patients) had hypermetropia (84.8%). All the patients who had hypermetropia also had esotropia.

DISCUSSION

Previous studies on strabismus have reported varying prevalence rates.^[2-16] In this study, the prevalence of strabismus was found to be 2.6%. This is slightly below the global prevalence of 3%–5% but agrees with prevalence rates reported in recent studies.^[10-16] It is believed that in recent times, the awareness that strabismus is treatable has improved the health-seeking behavior of parents. This has led to an increasing number presenting with their children at an earlier age than was seen in previous studies.^[13,14] There was a fairly equal distribution of males and females which agrees with a previous study conducted in Benin City.^[9] Majority of the patients (63.7%) in this study were under the age of 5 years with the age range from 5 months to 14 age at presentation.

Table 1: Age distribution of children and type of strabismus

Strabismus	Age distribution (years)		
	0-5, n (%)	6-10, n (%)	11-15, n (%)
Esotropia	33 (60.0)	12 (21.8)	2 (3.6)
Exotropia	2 (3.6)	2 (3.6)	2 (3.6)
Hypertropia	2 (3.6)	0	0
Total	37 (67.3)	14 (25.5)	4 (7.3)

$P=0.78$

Strabismus has been found to be associated with refractive error. Studies have shown esotropia to be commonly associated with hypermetropia and exotropia to be associated with myopia.^[7-9,16] This was observed in this study. One of the children who had high hypermetropia (+5.00 DS) and esotropia (60 prism diopters) had treatment for retinopathy of prematurity.

Table 2: Ocular comorbidity versus strabismus

Variable	Esotropia, n (%)	Exotropia, n (%)	Hypertropia, n (%)	Test (Fisher's exact test)	P
Refractive error					
Hypermetropia	28 (54.9)	0	0	2.154	0.2957
Myopia	0	3 (5.9)	0		
Astigmatism	0	0	2 (3.9)		
NLDO	1 (2.0)	0	0	2.369	1.000
Cornea					
Microcornea	4 (7.8)	0	0	7.017	0.231
Opacity	0	1 (2.0)	0		
Conjunctiva					
Conjunctivitis	2 (3.9)	0	0	2.800	0.4314
Lens					
Cataract	6 (11.8)	2 (3.9)	1 (2.0)	10.573	0.123
Retina					
ROP	1 (2.0)	0	0	2.369	1.000

NLDO: Nasolacrimal duct obstruction; ROP: Retinopathy of prematurity

Table 3: Association of refractive error with type of strabismus

Strabismus	Refractive error			
	Hypermetropia, n (%)	Myopia, n (%)	Astigmatism, n (%)	Emmetropia, n (%)
Esotropia	28 (50.9)	0	0	19 (34.5)
Exotropia	0	3 (5.5)	0	3 (5.5)
Hypertropia	0	0 (0.0)	2 (3.6)	0
Total	28 (50.9)	3 (5.5)	2 (3.6)	22 (40.0)

Kushner^[22] reported a higher incidence of strabismus, amblyopia, and high refractive error among children with retinopathy of prematurity. This shows that strabismus can coexist with other ocular disorders.

The high incidence of refractive error in this study (64.7%) agrees with the study by Baiyeroju and Owoeye^[7] as well as Zhu *et al.*^[23] where 50% and 41.6% of the children had strabismus with refractive error, respectively. The study by Zhu *et al.* highlighted the close association between childhood strabismus and refractive error, recommending that strabismus should be considered when managing childhood refractive error.

Strabismus can coexist with cataract. Nine out of 55 patients (16.3%) had cataract in this study. This high incidence agrees with Umar *et al.*^[24] in Kaduna who reported strabismus to occur in 35.4% of children with cataract. Strabismus could occur following cataract due to poor vision induced by the cataract and inability to maintain adequate sensory and motor fusion mechanisms.^[25] This is more observed when the patient has unilateral cataract. The study by Spanou *et al.*^[26] has shown the incidence of strabismus to be higher in patients with unilateral cataract (27.4%) compared to those with bilateral cataract (19.6%). All the patients in this study had unilateral cataract.

Ocular comorbidities identified in this study included vision-impairing diseases such as corneal opacity, cataract, retinopathy of prematurity, and refractive error. Nonvision-impairing disorders were microcornea, conjunctivitis, and nasolacrimal duct obstruction. These diseases have been reported in previous studies to be associated with strabismus.^[16-20] Gu *et al.*^[20] reported amblyopia and strabismus which developed secondary to monocular corneal opacity following suspected epidemic keratoconjunctivitis. In this study, one patient had monocular corneal opacity which cause could not be determined.

This shows the need to fully investigate a patient with strabismus and identify coexisting pathologies, which when diagnosed would need to be managed appropriately in order to improve management outcome in strabismus. For patients who have refractive error, they should be corrected with spectacles and the angle of deviation monitored. Once the angle is stable which means there is no further reduction in the angle, surgical correction can be effected for the nonaccommodative part. Patients with cataract would need to have cataract extraction as part of their management. In a study which

combined both cataract and strabismus surgeries, the researchers concluded that in selected cases, combined surgery optimized the alignment of the visual axes, improved visual acuity, and minimized the need for additional procedures.^[27] Our findings being hospital-based may not be a true representative of what is obtainable in the general population.

CONCLUSION

The need to fully investigate the patient with strabismus cannot be overemphasized. This study has shown that strabismus can coexist with other ocular disorders which could be vision impairing, thereby interfering with visual prognosis. Some of these conditions are treatable once identified. It is, therefore, important to make the diagnosis and institute appropriate treatment of these ocular conditions.

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Conflicts of interest

There are no conflicts of interest.

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