Original Article

Risk Factors of Strabismus in Southwestern Nigeria

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Purpose: The risk factors for strabismus among Nigerian children have not been adequately determined despite the fact that strabismus is a significant cause of visual impairment among them. This study aims to evaluate such risk factors among some Nigerian children.

Material and Methods: School pupils aged between 2 and 17 years with manifest strabismus in some randomly selected elementary schools in Ilorin, Nigeria were screened. They were matched with controls comprising of children without ocular misalignment. The studied risk factors included prematurity, low birth weight, family history of strabismus and significant hypermetropia. A full ocular examination of each child included a noncycloplegic refraction using a Topcon 8000R autorefractomter.

Results: 7,288 school children were screened. There were 32 cases of strabismus (22 esotropia and 10 exotropia). Of the 32 cases of strabismus, 19 were males and 13 were females. There were 2 cases of significant hypermetropic astigmatism in strabismus group and 1 in controls (P > 0.05, odd ratio 1.0). Significant myopia occurred in 3 cases and in 1 controls (P >0.05, odd ratio 1.5). There were 6 cases of significant hypermetropia in cases and 1 in controls (P <0.05, odd ratio 8.0). There were 12 cases of positive family history in cases and 1 in controls (Odd ratio 19.8 and p<0.05).Prematurity was observed in 18.8% of the cases and *15.6%* of controls (P > 0.05,odd ratio of 1.2).

Conclusion: There is an association between heredity and strabismus. Significant hypermetropia was found to be a risk factor for strabismus.

Strabismus is a common ocular problem among children[1,2]. Although its pathogenesis and precise mode of inheritance is still obscure, several risk factors have been identified[3]. These include maternal cigarette smoking during pregnancy, increasing maternal age and maternal and paternal occupational lead exposures[4,5]. Recently, it has been suggested that mutation in the albinism genes tyrosinase, P gene and TYRP1 may be responsible for congenital esotropia[6].

Several studies have consistently shown that high hypermetropia is a risk factor for strabismus[7-10]. The relationship between strabismus and heredity is not in doubt. Studies in monozygotic, dizygotic and other forms of multiple births along with family studies of patients with strabismus have consistently established the hereditary basis of strabismus[11-15].

Prematurity and low birth weight are recognized risk factor for strabismus[16-19] infants with gestational age <32weeks have a significantly higher risk of developing strabismus compared with children with gestational age > 32 The risk of strabismus increases with low birth weight. For infants weighing 1.5kg at birth compared to those weighing 4.0kg at birth, the odd ratios were 3.26 for esotropia and 4.01 for exotropia[4].

Strabismus is a common cause of visual impairment among children and also has a tendency of causing amblyopia[20].The risk factor for strabismus among Nigerian children have not been adequately

determined despite the fact that strabismus is a significant cause of visual impairment among them.

This study was therefore carried out to evaluate the risk factors for strabismus among a group of Nigerian children.

MATERTALS AND METHODS

This study took place among elementary school children in Ilorin South Local Government Area of Kwara State, Nigeria from October 2005 to September 2006.

Case definition

These were school age children (2-17 years of age) of both sexes with manifest strabismus who were members of the participating schools and satisfied the inclusion criteria.

Controls definition

These were children without ocular misalignment or any other ocular pathology in the same school as the cases matched for age and sex with the cases. Included in the study were primary school pupils of any of the participating schools Excluded were children with manifest strabismus in the selected schools whose squint was associated with any systemic or ocular pathology e.g. cataract, macular scar, cranial nerve palsies etc.

The studied risk factors were prematurity, low birth weight, family history of strabismus and significant hypermetropia.

Prematurity was defined as birth of a child before 37 weeks from the last menstrual period of the mother (approximately 8 months gestational period) while low birth weight was taken as birth weight less than 2.5kg.

A positive family history of strabismus was said to occur when at least one member of a first or second degree relative is affected.

Significant hypermetropia was defined as hypermetropia equal to or greater than +3.5Ds (diopter shere) in one or both eyes while significant myopia refers to myopia greater than or equal to -3.0Ds in one or both eyes.

Significant astigmatism refers to astigmatism equal to or greater than +2.0Dcyl (dioptre cylinder) in any meridian in one or both eyes.

Informed consent was obtained from the education authority of the Ilorin South Local Government Area and from the parents of the children before commencement of the study. Ethical clearance was also obtained from the Ethical committee of the University of Ilonn Teaching Hospital.

A pilot study was earlier carried out to compare cycloplegic refraction using 1% Tropicamide with a non cycloplegic refraction using a Topcon 8000^{R} autorefractometer. Results showed that the difference between the two was not statistically significant.

A cluster random sampling technique was employed to select the cases and controls of the study. Each of the 33 public primary schools in the local government area numbered 001 to 033 represented a cluster. The clusters were arranged serially in a sampling frame from which clusters were selected randomly for screening using a simple random sampling technique. Any selected cluster was crossed to prevent its further selection. Every eligible member of a cluster was screened to select the cases and controls of the study.

In any selected school, screening proceeded from the most elementary class to the highest class. Each of the children was screened for ocular misalignment at distance and near using the Hirschberg's and the cover-uncover test. In any class where a case of ocular misalignment was found a control matched for age and sex was also selected. At the end of the screening exercise, the number of cases and controls were compiled and their biological parents were later invited to the school to meet with the researchers. At the meeting with the parents the questionnaires were completed and consent was obtained to examine the children further in a hospital (Ayo Bello Memorial Eye centre).

In the hospital, in the company of a school teacher assigned to follow the children, visual acuity was assessed using the snellen acuity chart (Letter and E' Optotype) and picture chart for children too young to comprehend the above charts. A full ocular examination including extraocular motility assessment, anterior segment examination and fundscopy was done. A non-cycloplegic refraction was then done for each child using a Topcon 8000^{R} autorefractomter followed by a dilated fundoscopy using 1% Tropicamide.

Each examination was carried out by an ophthalmologist (I.R) with the assistance of a school teacher who only helped to organize the children.

For each child, a questionnaire was completed by an ophthalmologist to obtain the child's initials, age, sex, school and class. Information obtained from the parents includes the child's birth weight, duration of gestation, and family history of strabismus. All collected data were cross checked and analyzed using Epi Info 6.04, SPSS 12.01 and a pocket sized scientific calculator.

Statement of ethics

We certify that all applicable institutional and governmental regulations concerning the use of human volunteers were followed during this research.

RESULTS

During the one year period, a total of 7,288 school children were screened (3.766 boys and 3522 grils). This yielded 32 cases of strabismus (22 esotropia and 10 exotropia). Of the 32 cases of strabismus, 19 wee males and 13 were females.

There were 6 cases of significant hypermetropia in cases and 1 in controls (P<0.05, odd ration 8.0), (Table 1).

Table 1: Relationship between significant refractive error and strabismus

Type of Error	Number		P-value
	Cases	Control	
Hypermetropia			
Significant (≥+3.5 DS)	6	1	>0.05
Not significant (≥+0.5+ <+3.5Ds)	14	18	
X^2=2.540, df= 1.0, odd ratio = 8.0 **Astigmatism**			
Significant (≥+2.0Dcyl) any meridian	2	1	>0.05
Not significant (≥+0.5+ <+2.0Dcyl) any meridian	10	5	
X^2=0.450, df= 1.0, odd ratio = 1.5 **Myopia**			
Significant (≥+3.0Ds)	3	2	0.05
Not significant (≥+0.5 + <-3.0Ds)	5	5	
X^2=0.030, df= 1.0, odd ratio = 1.5 **Emmetropia** (0-<±0.50 Ds/cyl)			
Any meridan	4	6	>0.05
Total	44	38	

There were 2 cases of significant astigmatism in cases and 1 in controls (P> 0.05, Odd ratio 1.0).

Significant myopia occurred in 3 cases and in 1 controls (P>0.05, odd ration 1.5). There were 12 cases of positive family history in cases and 1 in controls (Table 2) with and odd ration of 19.8 and P<0.05.

Table 2: Heredity and strabismus

Factor	No. of patients n (%)			P-value
	Cases n (%)	Control n (%)	Total n (%)	
Family History	12 (37.5)	1 (3.1)	13 (20.3)	<0.05
No family history	18 (56.3)	28 (87.5)	46 (71.9)	<0.05
No response	2 (6.25)	3 (9.4)	5 (7.8)	>0.05
Total	32 (100)	32 (100)	64 (100)	

X^2= 11.680, df =2.0 Odd ratio

This familial tendency has no significant inclination towards either esotropia or exotropia (Table 3).

There were 8 cases of positive family history in esotropia and 4 in exotropia. The difference is not statistically significant (P>0.05).

Prematurity was observed in 18.8% of the cases and 15.6% of controls (P>0.05) with an odd ration of 1.2 (Table 4).

Table 5 shows that 25.0% of the cases had low birth weight while 20.3% of controls had low birth weight (P>0.05) with an odd ration of 2.0.

Table 3: Family history in relation to type of strabismus

Factor	Type of strabismus n (%)		P-value
	Esotropia n (%)	Exotropian n (%)	
Family History	8 (36.4)	4 (40)	<0.05
No family history	12 (54.6)	6 (60)	<0.05
No response	2 (9.)	0 (0)	<0.05
Total	32 (100)	10 (100)	

X^2 = 0.972, df=2.0

Table 4: Prematurity and strabismus

Factor	No. of patients n (%)			P-value
	Cases n (%)	Control n (%)	Total n (%)	
Permaturity	6 (18.8)	5 (15.6)	11 (17.2)	<0.05
Term Gestation	24 (75)	24 (75)	48 (75)	
Non-response	2 (6.3)	3 (9.4)	5 (7.8)	>0.05
Total	32 (100)	32 (100)	64 (100)	

$X^2 = 0.290$, df = 2.0Odd ratio = 1.2

Table 5: Low birth weight and strabismus

Factor	No. of patients n (%)			P-value
	Cases n (%)	Control n (%)	Total n (%)	
Low birth weight	8 (25)	5 (15.6)	13 (20.3)	<0.05
Normal birth weight	12 (37.5)	15 (46.9)	27 (42.2)	<0.05
Non-response	2 (6.3)	3 (9.4)	5 (7.8)	>0.05
Don't know	10 (31.3)	9 (28.1)	19 (29.7)	<0.05
Total	32 (100)	32 (100)	64 (100)	

$X^2 = 1.280$, df = 3.0 Odd ratio = 2.0

DISCUSSION

A family history of strabismus was established in 37.5% of cases in this study and 3.1% of controls (P < 0.05). Cases with family history were 20 times more likely to develop strabismus compared with controls. This is similar to the findings of Abeba and Abebe[21] in Ethiopia and Mvogo et al[13] in Cameroun. Abeba and Abebe found that 34.5% of cases of strabismus studied showed a positive family history while Mvogo et al reported positive family history in 28.7% cases studied. However, these findings are lower than those reported by Ferreria et al[1] and Dufier et al[22] who reported a positive family history in 65.4% and 73.0% of cases respectively. In this study, there was no statistically significant difference in the percentage of familial cases with regard to the type of strabismus. 36.4%, and 40% of esotropia and exotropia respectively report a positive family history (P> 0.05). This is consistent with the findings of Mvogo et al[13] in Cameroun.

With significant hypermetropia occurring in 6 cases and in 1 control, the relationship between significant hypermetropia and strabismus is statistically significant (P <0.05). Cases with significant hypermetropia are 8 times more likely to develop strabismus compared with controls. This is similar to the findings of previous authors[8,23,24] Significant hypermetropic astigmatism occurred in 2 cases and in 1 control and significant myopia occurred in 3 cases and 2 controls. The relationship between significant hypermetropic astigmatism and strabismus and between significant myopia and strabismus was not found to be statistically significant (P > 0.05, odd ratio 1.0 and 1.5) respectively. This is contrary to the findings of previous authors[8,23,24]. Ingram and Walker 8 found that bilateral spherical hypermetropia ≥ + 2.0 Ds and or hypermetropic astigmatism ≥ + 1.0Dcyl was significantly associated with strabismus (P = 0.0779%). Atkinson et al[23] found that children with abnormal hyperopia (≥ + 3.5 Ds) are 13 times more likely to develop strabismus compared with controls. Also IrLgram et al[24], showed that + 2.5Ds of hypermetropia in any meridian in either eye is significantly associated with strabismus (P=0.00000005%). Abnormal hypermetropia is a risk factor for accommodative esotropia[24]. The criteria for abnormal refraction (significant refractive error) used in this study is slightly different from that used by previous authors. Similarly the age range of children in previous studies differs from the age range of children in this study. These may explain why the findings of this study is slightly different from those of previous authors.

With 18.8% of cases and 15.6% of controls born before 37 weeks of gestation, the relationship between prematurity and strabismus is not statistically significant in this study (P > 0.05). This is contrary to the findings of previous authors[16,17] Schalij - Delfos et al[16], found that prematurity is a risk factor for strabismus (P < 0.05). Infants with gestational age <= 32 weeks have a significantly higher risk than infants with gestational age> 32 weeks. Infants with gestational age> 32 weeks develop incidence of strabismus comparable to the normal population. Galo and Lennerstrand[17], also observed a significant association between prematurity and strabismus. They found an incidence of strabismus of 9.9% in premature children and 2.1% in full term children. In our environment, children born before 32 weeks of gestation hardly survive because of complications associated with prematurity and the paucity of good neonatal care. It is very probable that most

prematurity observed in this study have gestational age > 32 weeks. Since children with GA > 32 weeks develop an incidence of strabismus comparable with normal populations[16], this may partly explain the findings of this study.

Low birth weight occurred in 25% of cases and 15.6% of controls in this study. Thus the relationship between low birth weight and strabismus is not statistically significant (P > 0.05). This is contrary to the findings of previous authors[4,25]. Chew et al found that the risk of strabismus increases with low birth weight (P < 0.0001). For children weighing 1.5kg at birth compared to those weighing 4.0kg at birth, the odd ratios were 3.26 for esotropia and 4.10 for exotropia. Mc Ginnity and Bryas25, found the prevalence of strabismus in low birth children to be 19% and 2.5% in normal birth weight children. It was not possible to obtain birth weight of children in 3 1.3% of cases and 28.1% of controls in this study. This is due to poor record keeping by the parents and the probability that most of these children may not have been delivered in the hospital. This may partly account for the disparity between the findings of this study and the findings of previous authors.

In conclusion there is an association between heredity and strabismus. However, there is no statistically significant difference in the occurrence of positive family history in esotropia and exotropia. Significant hypermetropia was found to be a risk factor for strabismus. The relationship between prematurity, low birth weight and strabismus respectively could not be satisfactorily determined in this study because of poor obstetric records.

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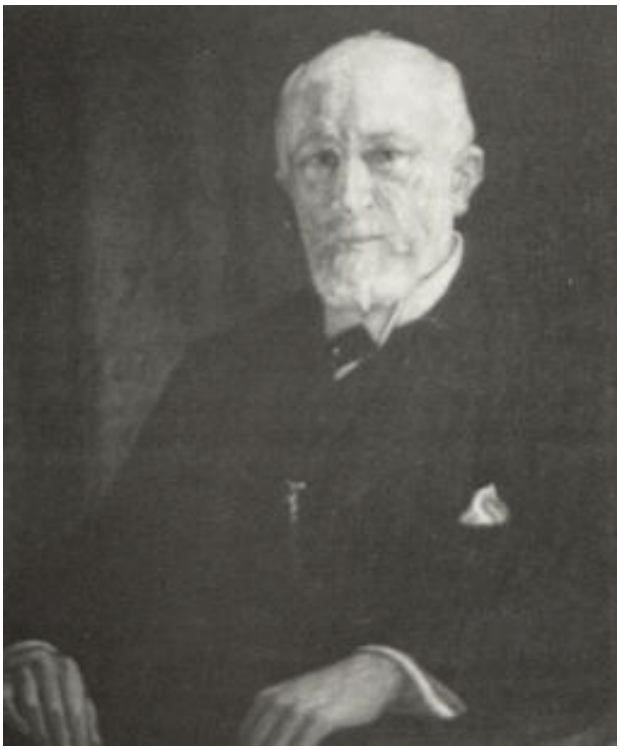
Guess Who



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