

**Research Article**

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Risk Factors of Strabismus in Children in a Southern Nigerian Tertiary Hospital

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Background: Strabismus is a misalignment of the eyes affecting one or both eyes. The deviation of the eyes could be esodeviation, exodeviation, hyperdeviation or hypodeviation. Its prevalence is low globally and varies in different regions of the world. In our local environment esotropia is the commonest form of presentation. The possible risk factors that predispose a child to developing strabismus is necessary for early mitigation.

Objective: The aim of this study is to determine the possible risk factors of strabismus among children attending the Paediatric Ophthalmology Clinic in the university of Port Harcourt Teaching Hospital (a tertiary hospital) in the Niger Delta Region, Nigeria.

Method: One hundred and twenty-five (125) consecutive children with manifest strabismus attending the Pediatric Ophthalmology Clinic of the University of Port Harcourt Teaching Hospital from October 2016 to March 20 18 were recruited for the study.

Results: The prevalence of manifest strabismus was 6.6%. Refractive error (hypermetropia and astigmatism) was the most prevalent ocular risk factor seen among these children. Other risk factors were amblyopia, prematurity, low birth weight, family history of strabismus and female sex.

Conclusion: Adequate cycloplegic refraction should form a baseline clinical procedure for children presenting with strabismus.

Keywords: Children; Risk factor; Strabismus

Introduction

Normal binocular single vision is the ability of the visual cortex to fuse and integrate the image from each eye into a single perception which develops after birth from early infancy and is completed with fusion and stereopsis by age 8-10years [1]. Strabismus is a misalignment of the eyes such that the visual axes of both eyes are not simultaneously directed at the object of regard [2]. Ocular misalignment is common in newborns because humans are often born with a slight exodeviation thought to represent the anatomic position of the divergent orbit [3]. A study done in university of Liverpool found the prevalence of strabismus to be about 73.1% in one-month old babies, reducing to 49% in two months old and virtually disappearing in normal four-month-old babies [4]. In cases where the patient tends to consistently fixate with one eye and squint with the other, amblyopia is bound to set in especially in young children due to the continuous abnormal visual stimulation from the weaker eye during early visual development

with subsequent disruption of neurodevelopment of the visual centers in the brain [5,6].

Strabismus is a relatively common condition worldwide especially among newborns with a prevalence of 1.3% -5.7% in all children with an increased prevalence associated with assisted delivery, low birth weight, prematurity and associated neuro-developmental disorders [7,8].

In America, a population-based study of strabismus among Native American children showed a prevalence of 3.8% [9]. Asian population reveal a lower prevalence of 0.7-1.9% [10,11]. About 3-4% of Caucasian children have also been reported to be affected with strabismus [12]. The prevalence in Africa is generally low compared to Caucasians and Asians as seen in various studies [13,14]. In Nigeria the prevalence of strabismus is between 0.01-2.4% in different populations [15-22]. In a retrospective study conducted in the university of Port Harcourt Teaching Hospital

the prevalence of strabismus was 0.6% and majority was found between the age group of 0-10 years (75.7%) [16].

Risk factors of strabismus in children include refractive error, positive family history, history of maternal cigarette smoking during pregnancy, low birth weight, prematurity, developmental ocular abnormalities such as craniofacial abnormalities (e.g. Crouzon Syndrome), cataract, retinoblastoma and retinopathy of prematurity [23-31]. Hypermetropia was most commonly found among children with esotropia and myopia among children with exotropia [23,32]. Other risk factors of strabismus include systemic disorders such as meningitis, encephalitis, neonatal jaundice, cerebral palsy, Down's syndrome and fetal alcohol syndrome [33-41].

Strabismus affects a child's psychology and social interaction, and this cannot be neglected. Patients with strabismus are said to have lower levels of psychological well-being, are less accepted by their peers and the society at large [42,43]. This underscores the importance of this study- to identify the risk factors associated with strabismus in our locality and hence improve in the management of our patients.

Materials and Method

The study design is a hospital based descriptive cross-sectional study conducted over a period of twenty-four months. The sampling technique used was a consecutive sampling method in which all children with manifest squint attending the Pediatric Ophthalmology Clinic, university of Port Harcourt Teaching Hospital from October 2016 to March 2018 were recruited consecutively into this study. The university of Port Harcourt Teaching hospital serves as a catchment as well as a referral Centre for inhabitants of Rivers State and neighboring Bayelsa, Imo and Abia states.

An interviewer-administered questionnaire was administered in the clinic to the assenting patients whose parent/guardian has given consent. Relevant information on socio-demography such as birth history, age at onset of squint, history of previous trauma, previous eye surgery and family history of squint were obtained from either parent/guardian via interviews. Visual acuity (VA) was tested in preverbal children (0-2yrs) using preferential looking, Central, Steady and Maintained fixation, fixating and following of bright light or bright colored toy. While in verbal children (>2yrs), visual acuity was done with a picture optotype test e.g. Kay's pictures test; which uses pictures of objects like cars, trains houses, bikes, animals. Snellen acuity chart or illiterate E-chart asking the child to point his/her finger to the direction of the E. Pin-hole testing was done for subjects with VA of 6/12 and worse.

Corneal light reflex (Hirschberg's test) was carried out for near and target object. The position of the light reflection on each cornea with reference to the pupil was noted. Bruckner test was performed using the direct ophthalmoscope in a dark room to obtain a red reflex simultaneously in both eyes at arm's length. Cover and uncover test was also done monocularly at both near

and distance. It was done to detect presence of manifest squint and to differentiate between phoria and tropia. Alternate prism cover test was done to measure the total deviation which is the degree of deviation. The degree of deviation was assessed with modified Krimsky's test which is similar to Hirschberg's test except that the prism was placed in front of the fixating eye with the apex facing the direction of deviation to center the corneal reflection in the deviated eye.

Anterior segment examination was done with a pen torch and slit lamp looking out for the eyelids, size of the globe and extraocular muscles motility, conjunctiva and pupils. A dilated fundoscopy was done for all children using a binocular indirect ophthalmoscope to assess the macula, optic disc, and peripheral retina for any pathology such as retinoblastoma, glaucoma, optic disc coloboma, toxoplasmosis etc. All data generated was entered into a proforma and were analyzed using commercially available statistical data management software- Statistical Package for Social Sciences (IBM-SPSS) version 23.

Consent and Ethical Clearance

Ethical clearance was obtained from the Ethical Committee of University of Port Harcourt Teaching Hospital. Informed written consent and assent were obtained from each patient's parent before enrolment into the study in accordance with Helsinki Declaration involving human subjects [44].

Results

(Table1)

Table 1: Age and sex distribution of study population.

Age Range (Yrs.)	Sex		
	Male (n %)	Female (n%)	Total (n%)
<1 year	6 (10.7)	11 (15.9)	17 (13.6)
1-3 years	15 (26.8)	22 (31.9)	37 (29.6)
4-6 years	14 (25.0)	13 (18.8)	27 (21.6)
7-9 years	9 (16.1)	12 (17.4)	21 (16.8)
10-12 years	4 (7.1)	7 (10.1)	11 (8.8)
13-15 years	5 (8.9)	2 (2.9)	7 (5.6)
16-18 years	3 (5.4)	2 (2.9)	5 (4.0)
Total	56 (44.8)	69 (55.2)	125 (100.0)

Fisher's exact test = 4.235; p-value = 0.661

Sixty-nine were females (55.2%) while 56 were males (44.8%). Male to female ratio was 1:1.2. Mean age was 5.53±4.42years. Age range of 1-3years had the highest proportion 37 (29.6%) while those 16-18 years had the least representation 5(4.0%). The differences in the proportion of age categories between the males and females were not statistically significant (p =0.661).

(Table 2)

Esotropia has a prevalence of 4.3%, 38 (2.0%) subjects had exotropia out of which 15 were male and 23 were female while that for vertical deviation was 0.27% (hypertropia 0.16%, hypotropia 0.11%). The overall prevalence for heterotropia was 6.6%.

Table 2: Prevalence and gender distribution of types of strabismus.

Type of Strabismus	Males	Females	M: F	Total	Prevalence (95% CI)
Horizontal					
Esotropia	39	43	01:01.1	82	4.32% (3.48% - 5.31%)
Exotropia	15	23	01:01.5	38	2.00% (1.49% - 2.77%)
Vertical					
Hypertropia	0	3	0:03	3	0.16% (0.04% - 0.43%)
Hypotropia	2	0	2:00	2	0.11% (0.02% - 0.35%)
Total	56	69	01:01.2	125	6.59% (5.54%-7.78%)

M: F-Male to Female ratio; CI-Confidence Interval

Discussion

This was a cross sectional study conducted among 125 children with strabismus attending the pediatric eye clinic of the University of Port Harcourt Teaching Hospital. The aim of the study was to unravel the risk factors associated with strabismus among children in our locality.

The prevalence of strabismus in this study was 6.6% which was similar to the hospital-based study carried out in Tanzania (5.9%) [45] and Australia (7.3%) [46]. It was slightly higher than the global prevalence of 3–5% [47] and those reported in different parts of Nigeria [12-14,17-22]. Most of the studies done in Nigeria were primarily to assess ocular diseases in children, therefore standardized methods of examining strabismus may not have been applied which could have led to cases of missed strabismus [15,16,48]. However, the high prevalence obtained in this study is similar also to the findings of a population-based study in China [49]. In developed countries like China, there are better awareness to ocular health, improved health care facility, maternal nutrition and perinatal child health care; these factors probably account for the low prevalence of strabismus. The relative high prevalence of strabismus in our study, could be attributed to the fact that all children presenting with strabismus were included in this study (not just healthy children) and the prevalence was calculated in relation to the total number of children presenting within the study period. In addition, this study was hospital-based and more yield of patients with strabismus was expected.

In the course of this study different ocular and systemic morbidities were found to be implicating risk factors in manifest strabismus. These risk factors include refractive error, prematurity, family history and female sex. Refractive error was noticed in 64.6%. Hypermetropia was the commonest type seen amongst the subjects; this finding was similar to findings in a clinic-based study by Al-Tamini [32], Zhu [49], Baiyeroju [20], Bodunde [17] and Azonobi, et al. [15]. Hypermetropia was found to be more common in subjects with esotropia in this study, which is similar to studies done in other parts of the world such as United States 47 China 50 and Australia 51. This was followed by astigmatism (22%). The multiethnic pediatric eye disease study/Baltimore pediatric eye disease study observed that astigmatism was implicated in exotropia 26 but in this study astigmatism was implicated in esotropia. Also, in this study, 16% of the subjects were myopic and was found to be more prevalent among subjects with esotropia.

In contrast to the findings of Zhu, et al. [49], Azonobi, et al. [23] who observed that myopia was predominant among subjects with exotropia. In our study, maternal smoking in pregnancy was not considered a risk factor because smoking among females is rare in our locality.

Amblyopia is a cause of visual impairment in children especially those with strabismus. The prevalence of amblyopia in this study was 16.0%. It is the second most implicating risk factor seen in this study. It is more prevalent among the esotropic subjects. Systemic co-morbidities found among the subjects in this study included cerebral palsy /birth asphyxia, neonatal jaundice, oculocutaneous albinism, low birth weight, meningitis, and sickle cell disease. These are similar to the findings in Tanzania [50]. Cerebral palsy is almost equally found among subjects with esotropia and exotropia. Prematurity/ low birth weight was also seen among subjects with esotropia in this study.

Acknowledgement

None.

Conflict of Interest

The authors hereby declare that there is no conflict of interest.

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