

Refractive Amblyopia among children in Ibadan: the need for amblyopia screening programmes

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Abstract

Background: The prevalence and burden of amblyopia in developing countries is probably underestimated, and little is known about the pattern of amblyopia in West Africa.

Aim: To determine the relative frequency and types of amblyopia among children with refractive errors seen in the eye clinic of a tertiary hospital over a 2 year period.

Methods: A cross-sectional study conducted at the eye clinic of the University College Hospital, Ibadan, Nigeria between January 2012 and December 2013. Case notes of children with refractive errors seen during this period were retrieved and information including socio-demographic data, presenting visual acuity and visual acuity with correction were recorded. Amblyopia was defined as best corrected visual acuity worse than 6/9 or a difference of ≥ 2 Snellen chart lines between both eyes in the absence of any ocular pathology that could explain the visual impairment.

Results: A total of 250 eligible patients who had refractive errors were included in the study. Visual acuity was corrected to 6/9 or better in 224 (89.6%) children while 26 (10.4%) of them had amblyopia. Among the 26 children with amblyopia, 21 (80.8%) children had amblyopia in both eyes and majority (65.4%) had iso-ametropic amblyopia. Of the 47 amblyopic eyes, 36 (76.6%) eyes had moderate amblyopia while 11 (23.4%) eyes had severe amblyopia.

Conclusion: There is a high relative frequency of amblyopia in this study and we recommend preschool eye examinations for all children to ensure early detection and management of amblyopia, thereby reducing the burden of amblyopia in our populace.

Keywords: Amblyopia, refractive error, vision, children, Nigeria

Résumé

Contexte: La prévalence et la charge d'amblyopie dans les pays en voie de développement est probablement sous-estimées, et on en sait peu sur le modèle de l'amblyopie en Afrique de l'Ouest.

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But: Pour déterminer la fréquence relative et types d'amblyopie parmi les enfants avec des erreurs réfractives vus à la clinique de l'œil d'un hôpital de soins tertiaires sur une période de 2 ans.

Méthodes: Une étude transversale menée à la clinique de l'œil du Collège Hospitalier Universitaire, Ibadan, Nigeria entre Janvier 2012 et Décembre 2013. Les notes de cas d'enfants avec des erreurs réfractives vu pendant cette période ont été récupérés et informations, y compris les données sociodémographiques, présentant acuité visuelle et l'acuité visuelle avec correction ont été enregistrées. Amblyopie a été définie comme une acuité visuelle au mieux corrigée pire que 6/9 ou une différence de ≥ 2 lignes du diagramme de Snellen entre les deux yeux en l'absence de toute pathologie oculaire qui pourrait expliquer la déficience visuelle.

Résultats: Un total de 250 patients admissibles qui ont eu des erreurs réfractives ont été inclus dans l'étude. L'acuité visuelle a été corrigée à 6/9 ou mieux dans 224 (89,6%) des enfants, tandis que 26 (10,4%) d'entre eux avaient une amblyopie. Parmi les 26 enfants atteints d'amblyopie, 21 (80,8%) des enfants présentaient une amblyopie dans les deux yeux et la majorité (65,4%) avaient amblyopie iso-amétrope. Parmi les 47 yeux amblyopes, 36 (76,6%) yeux présentaient une amblyopie modérée tandis que 11 (23,4%) yeux avaient amblyopie sévère.

Conclusion: Il ya une fréquence relative élevée d'amblyopie dans cette étude et nous recommandons des examens oculaires préscolaire à tous les enfants pour assurer tôt la détection et la gestion d'amblyopie, réduisant ainsi le fardeau d'amblyopie dans notre population.

Mots-clés: Amblyopie, erreur réfractive, vision, enfants, Nigeria

Introduction

Amblyopia is defined as poor visual acuity despite appropriate spectacle correction of refractive errors with the exclusion of structural abnormalities of the eye or the posterior visual pathway [1]. In amblyopia, the constant visual stimulation required for the proper development of the visual system during early childhood is either inadequate or abnormal.

Identified risk factors for amblyopia include high refractive errors, anisometropia (significant

difference between the refractive errors of both eyes), squint, ptosis, and opacities of the ocular media such as corneal scar and cataract. Refractive errors, particularly when associated with anisometropia, are the commonest cause of amblyopia [2]. Irrespective of the cause or risk factor, the underlying mechanisms in the development of amblyopia are either abnormal binocular interactions between the two eyes and/or deprivation of vision in one or both eyes [1]. Descriptive terms such as 'functional amblyopia' have been used to connote amblyopia that is potentially reversible while 'organic amblyopia' describes that which is refractory or irreversible [3].

Amblyopia has been found to be a common cause of unilateral visual impairment in the general population [2, 4, 5]; and it is said to be the most common cause of monocular visual loss in children and young adults [6-8]. Its prevalence varies across different settings and among different age groups. It has been reported as ranging from 2-4% in North American population [9] and was found in 9.1% of children less than 15 years in Ethiopia [10]. More recently, population-based studies have observed lower rates of amblyopia (0.28% - 1.5%) among African and African-American children compared to other ethnic groups such as Asians, Latino and Caucasians [11-14]. Among preschool children, the prevalence of amblyopia is reported to be lower, in the range of 0.2% - 1.8% [15], however in the presence of refractive error, the values are in the range of 2-5.7% [15] with anisometropia and high ametropia (refractive error) accounting for the majority of cases.

If left untreated, amblyopia may result in lifelong visual impairment [4]. The resultant economic and psychological burden of untreated amblyopia is probably underestimated especially in developing countries. There have been suggestions that amblyopia may have an adverse effect on an individual's educational and occupational opportunities [7, 8]. In addition, there is an increased risk of bilateral visual impairment, following trauma to the better eye, among individuals with unilateral amblyopia [16-19]. So, detection and treatment of amblyopia is beneficial in the long run.

To be effective, however, amblyopia treatment should be given during the "critical period" of visual development [6, 20]. This sensitive period is generally accepted to be the first 7 years of a child's life [21]. For this reason, screening programmes are routinely conducted in many industrialised countries and they have been shown to be effective in the early detection of children with amblyopia [22,23].

In view of the limited information about the profile of amblyopia in Nigerian children, this study was carried out with the aim of determining the relative frequency and types of amblyopia among children with refractive errors seen at the eye clinic of a tertiary hospital in south west Nigeria.

Materials and methods

This was an observational cross-sectional study conducted at the paediatric eye clinic of the University College Hospital Ibadan. Ethical approval and clearance was obtained from the ethical committee of the University College Hospital Ibadan. Case notes of all children aged ≤ 15 years who had refractive errors and were seen between January 2012 and December 2013 were retrieved. Information recorded included socio-demographic data, presenting visual acuity, best corrected visual acuity (BCVA) following refraction, type of refractive errors and the spherical equivalent of the refractive correction. The visual acuity of children aged 3 to 5 years was assessed with the use of Leas symbols while older children had visual acuity assessment using Snellen's alphabet chart placed six meters away from the child. All visual acuities were tested unilaterally and were recorded in the Snellen's acuity notation. Children who were not able to undergo an objective visual acuity assessment using either a Leas or a Snellen's chart were excluded from the study. All children underwent complete ophthalmic evaluation including examination of the anterior and posterior segments. Those children who had refractive errors associated with other ophthalmic conditions such as strabismus, allergic conjunctivitis, chalazia, ptosis, etc. were also excluded from the study.

Cycloplegic retinoscopy (using a streak retinoscope) was performed on all children aged ≤ 5 years as well as all children with hyperopic errors. Cycloplegia was achieved with the instillation of tropicamide (1%) eye drops during clinic hours. Such children returned for a subjective post mydriacyl test a week after the cycloplegic retinoscopy. Children older than 5 years with myopic errors had non cycloplegic retinoscopy and subjective refraction on the same clinic appointment.

The retinoscopy and refraction was performed by a senior optometrist with over 20 years' experience in the refraction of children.

A three month follow up appointment was scheduled for all patients to evaluate spectacle adaptation and commence amblyopic therapy where indicated. Amblyopia in this study was defined as BCVA worse than 6/9 after refraction in any eye in

the absence of any ocular pathological finding or when the BCVA of one eye was worse than the other by 2 or more Snellen acuity lines. Myopia was diagnosed as a spherical error of ≥ -0.5 diopters (D), hyperopia as spherical error of $\geq +2.00$ D, and astigmatism as a cylindrical error of ≥ 0.75 D. Anisometropic amblyopia was defined as unilateral amblyopia in the presence of a difference of >1.5 D in the spherical equivalents of both eyes while isoametropic amblyopia was defined as bilateral amblyopia in the presence of high refractive errors ($\geq \pm 4$ D). Meridional amblyopia was defined as unilateral or bilateral amblyopia in the presence of

an astigmatism of ≥ 2 D. Moderate amblyopia was defined as BCVA from 6/12 to 6/24, while severe amblyopia was defined as BCVA of $\leq 6/36$. Collected data was analysed with the Statistical Package for Social Sciences (SPSS version 22; IBM Corp., New York, NY, USA)

Results

A total of 250 children with refractive errors seen within the study period met the inclusion criteria and were studied. Their mean age was 10.9 (± 2.9) years with a male to female ratio of 1:2.

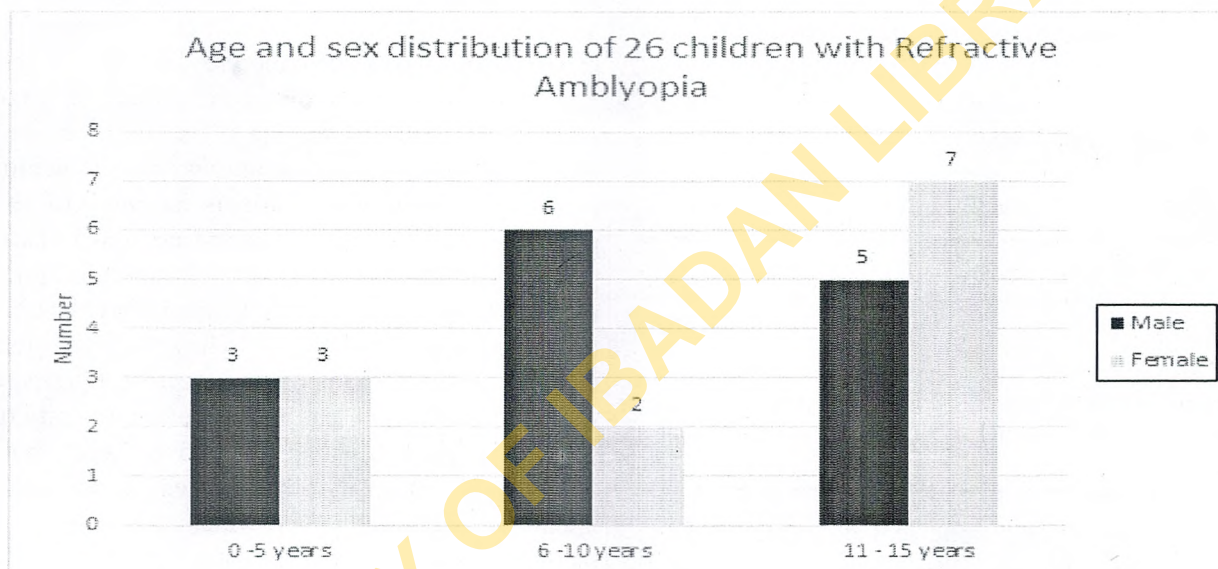


Fig.1: Age and sex distribution of 26 children with Refractive Amblyopia

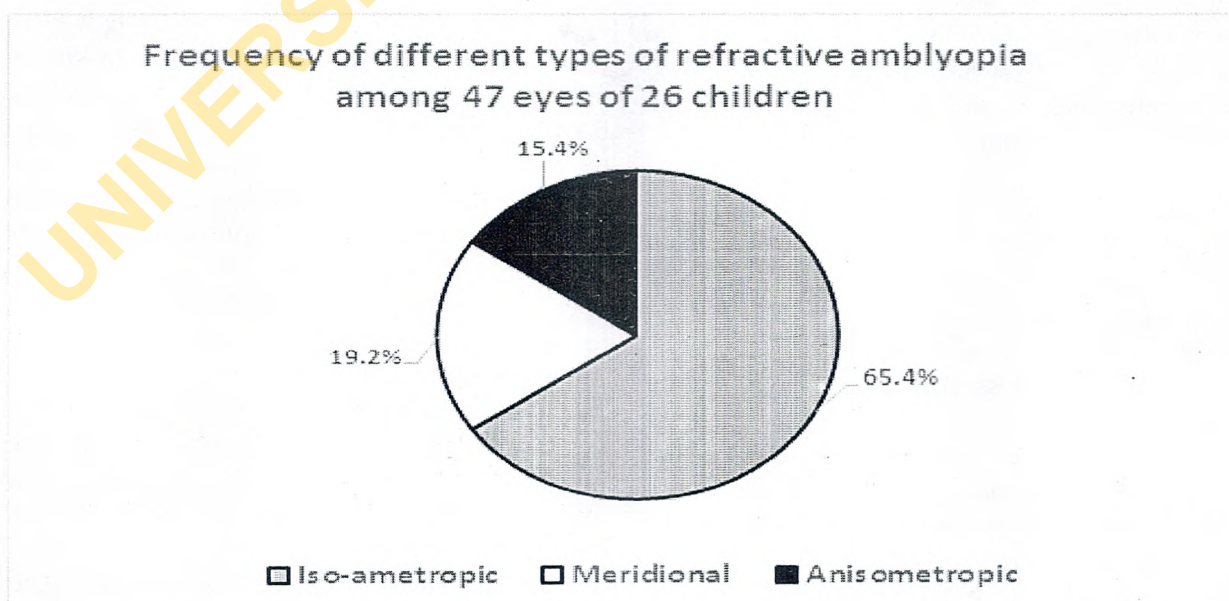


Fig. 2: Frequency of different types of refractive amblyopia among 47 eyes of 26 children.

Out of these 250 children, 224(89.6%) had visual acuity of $\geq 6/9$ with correction in both eyes while 26 (10.4%) children had BCVA worse than 6/9 (range 6/12-6/60) in at least one eye and were considered to have refractive amblyopia. The mean age of the children with amblyopia was 9.7 (± 3.8) years with a range of 4 -15 years. Fourteen (53.8%) of them were boys. The age and sex distribution of these children is presented in figure 1.

Twenty-one (80.8%) of the children with amblyopia had bilateral involvement; five (19.2%) children had unilateral amblyopia. Thus, a total of 47 eyes had amblyopia. With regards to the severity of amblyopia, 36 (76.6%) eyes had moderate amblyopia while 11 (23.4%) had severe amblyopia. The distribution of the different types of amblyopia diagnosed in these eyes are presented in figure 2 while table 1 shows the types of refractive errors found in the amblyopic eyes.

Table 1: Types of refractive error in 47 amblyopic eyes

Type of Refractive Errors	Freq	Percent (%)
Simple Myopia	11	23.4.0%
Simple Hyperopia	3	6.4%
Myopic Astigmatism	24	51.1%
Hyperopic Astigmatism	9	19.1%
Total	47	100%

The median spherical equivalent of the refractive correction of all amblyopic eyes was -5.25 D with a range of +10.50 to -18.50D. There were 35 (74.5%) eyes with myopic spherical equivalents and 12 (25.5%) eyes had hyperopic spherical equivalents. The median spherical equivalent of the 35 myopic eyes was -9.50D (Range: -0.75 to -18.00D) while the median spherical equivalent of the 12 hyperopic eyes was +4.00D (Range: +3.25 to +10.00D).

Discussion

The relative frequency of amblyopia among children with refractive errors observed in this study is similar to the figure of 9.1% reported among Ethiopian children [10]. It is, however, higher than the range of 1-6% reported by similar hospital based studies conducted in Asia and Europe [24-26]. This difference may be explained by variations in the definition of amblyopia used in the various studies as well as subtle differences in the characteristics of the study populations. Nevertheless, the wide difference between the Nigeria and Ethiopia figures on one hand and the Asian and European figures on the other may more likely be as a result of the dearth of structured and well organised screening

programmes for refractive errors and amblyopia among the African children [10].

It is important to bear in mind the fact that hospital based studies are quite unreliable in the determination of the prevalence of health conditions within the community. This is especially so with respect to studies conducted in tertiary hospital settings because of referral bias and the pooling effect of studying hospital patients. Therefore, the relative frequency obtained in this study may be an overestimation of the true prevalence of amblyopia among ametropic children in south-west Nigeria. Notwithstanding, we believe this figure is a fair reflection of magnitude of amblyopia among the children in the communities served by our hospital, particularly because of the lack of screening programmes among our children.

Conversely, the relative frequency figure of 10.4% in this study may, in fact, be an underestimation of the community prevalence of refractive amblyopia. This is because of the possibility of poor parental awareness about visual problems in their children [25]. In addition, poor uptake of eye care services has been reported within the Nigerian population [27]. Thus, it is plausible that the children seen at our clinic represent the more severe cases who present because of the severity of visual impairment and its impact on their education. Accordingly, those with milder degrees of visual impairment and amblyopia, which are likely to be more common, may not present to hospital. In the light of the foregoing, there is an urgent need for population-based studies on the epidemiology of amblyopia in Nigeria.

The amblyopic children in this study were, on average, slightly older than those in similar hospital based studies whose mean age ranged between 6.9 and 8.6 years [10, 25, 28]. This portrays the fact that the children with refractive amblyopia in our setting tend to present late. Late presentation is probably related to lack of awareness about amblyopia among parents and guardians. The implication of such late presentation is that response to treatment is poor beyond the age of 7-8 years following the expiration of the critical period of visual development [20]. It is imperative to reverse this trend of late presentation and diagnosis in order to reduce the magnitude of life-long visual impairment that results from delayed or deficient amblyopia treatment.

The relative frequencies of the various types of amblyopia found within the study population are quite different from the reports of previous studies. Although most of the previous studies were not

limited to patients with refractive amblyopia, anisometropic amblyopia was unanimously more common than iso-ametropic amblyopia and meridional amblyopia [2, 4, 5, 25]. Therefore, our finding that iso-ametropic amblyopia occurred much more commonly than anisometropic and meridional amblyopia is notable and deserves further investigation, especially at the community level.

Lack of awareness about visual problems among the parents and teachers remains a possible explanation for the unexpectedly high proportion of iso-ametropic amblyopia. A child or student with bilateral visual impairment from refractive errors is more likely to be detected by a parent or teacher than one with unilateral visual impairment. It is therefore more likely that it is children with bilateral significant refractive errors that would seek help from an eye care provider. This emphasises the need for early detection through screening programs for preschool and school age children.

The laterality of amblyopia in our patients is not in harmony with the findings from similar studies. Ordinarily, since amblyopia is reported to be the commonest cause of monocular visual impairment in children [6], it would be expected that unilateral amblyopia should be more common than bilateral amblyopia. Indeed, previous studies have found that unilateral amblyopia is much more common than bilateral amblyopia with the proportion of bilateral cases ranging from 7- 29% [10, 24, 25, 28]. The large proportion of bilateral cases among our patients seems to be related to the fact that about two-thirds of them had iso-ametropic amblyopia which is a common cause of bilateral amblyopia [25]. About half of the amblyopic eyes were found to have myopic astigmatism. This is not surprising as myopia is common in this age group and astigmatism is likely to be symptomatic prompting presentation to an eye care facility. Reports from similar studies [24, 25] also showed a high proportion of astigmatism among ametropic children with amblyopia.

The major limitations of this study are that it was retrospective and hospital based. Nonetheless, our findings have brought to the fore the importance of further investigation into the epidemiology of amblyopia in our population as well as the possible implications of continued lack of awareness of amblyopia among parents and teachers.

In conclusion, the prevalence of amblyopia that is associated with refractive errors appears to be relatively high in our young population. A follow up study to determine the actual population prevalence is recommended. Health education campaigns about refractive errors and amblyopia are

necessary to raise the level of awareness in the community and to promote uptake of eye care services. We advocate for the establishment and reinforcement of preschool and school eye screening programmes among children to ensure prevention or early detection and treatment of amblyopia that occurs secondary to refractive errors. Early detection and management of amblyopia in children thus identified would enable a reduction in the socio-economic burden of amblyopia in children living in south west Nigeria.

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