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Ophthalmic congenital anomalies: spectrum and systemic associations in a Nigerian tertiary hospital

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Abstract

Background: To document the pattern of ophthalmic congenital anomalies and their associated systemic anomalies in Nigeria's foremost university teaching hospital.

Methods: Retrospective cross-sectional study conducted at the University College Hospital, Ibadan from January 2009 to December 2013. Clinic and ward registers of various departments and units in the hospital were reviewed to identify children with any structural abnormality, present at birth, which involved the eye and/or its adnexae.

Results: Two hundred and forty eight children with 259 ophthalmic congenital anomalies were studied. The median age was 1.2 years with an interquartile range of 4.6 years. The male to female ratio was 1.27:1. Congenital cataract was found in 109 (44%) patients; 40 (15.4%) children had congenital glaucoma, and whole globe anomalies were observed in 18 (6.9%) children. Eighteen (7.9%) children had a family history of congenital anomalies. Associated systemic congenital anomalies were seen in 32 (12.9%) patients with the most common being cardiovascular anomalies in 13 (5.2%) patients. Children who had congenital cataracts were more likely to have multiple associated systemic anomalies ($p<0.005$). All the children who had associated cardiovascular anomalies had congenital cataracts ($p= 0.001$).

Conclusion: The commonest ophthalmic congenital anomaly presenting for tertiary care in Ibadan is congenital cataract. Cardiovascular anomalies are the commonest systemic association of ophthalmic congenital anomalies. There is an urgent need for the establishment of a registry for congenital anomalies with effective screening and active surveillance within the Nigerian health system.

Keywords: *Ophthalmic, congenital, anomalies, surveillance*

Résumé

Contexte: Pour documenter le profil des anomalies congénitales ophtalmiques et leurs anomalies systémiques associées dans l'hôpital universitaire le plus important du Nigéria.

Méthodes: Une étude rétrospective transversale menée au Collège Hospitalier Universitaire, Ibadan de janvier 2009 à décembre 2013. Les registres des cliniques et des salles de différents départements et unités de l'hôpital ont été examinés afin d'identifier les enfants présentant avec anomalies structurelles quelconques, présentes à la naissance, qui impliquaient l'œil et / ou ses annexes.

Résultats: Deux cent quarante-huit enfants avec 259 anomalies congénitales ophtalmiques ont été étudiés. L'âge médian était de 1,2 an avec un rang interquartile de 4,6 ans. Le rapport homme-femme était de 1,27: 1. La cataracte congénitale a été retrouvée chez 109 patients (44%); 40 (15,4%) enfants avaient un glaucome congénital et des anomalies globales ont été observées chez 18 (6,9%) enfants. Dix-huit (7,9%) enfants avaient des antécédents familiaux d'anomalies congénitales. Des anomalies congénitales systémiques associées ont été observées chez 32 (12,9%) patients avec les plus courantes étant des anomalies cardiovasculaires chez 13 patients (5,2%). Les enfants atteints de cataracte congénitale étaient plus susceptibles d'avoir de multiples anomalies systémiques associées ($p <0,005$). Tous les enfants qui avaient des anomalies cardiovasculaires associées avaient des cataractes congénitales ($p = 0,001$).

Conclusion: L'anomalie congénitale ophtalmique la plus fréquente pour les soins tertiaires à Ibadan est la cataracte congénitale. Les anomalies cardiovasculaires sont les plus fréquentes associations systémiques d'anomalies congénitales ophtalmiques. Il est urgent de créer un registre des anomalies congénitales avec un dépistage efficace et une surveillance active dans le système de santé Nigérian.

Mots-clés: *Ophtalmique, congénitale, anomalies, surveillance*

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Introduction

The human eye starts to develop during the third week of intrauterine life from the optic vesicles [1]. Any impairment of this developmental process manifests as ophthalmic congenital anomalies, which range from total absence of the eye (anophthalmos) to less severe anomalies. Some of the latter that are noticed during routine eye examinations as incidental findings may be of no clinical significance to the patient [2]. These congenital eye anomalies are rare and may occur solely, in combination or as components of a craniofacial anomaly, syndrome or a genetic disorder [2-6]. They are varied in nature and can manifest as either an abnormal appearance of the eye or with poor vision. However, their early recognition is of significance in preventing disruption of normal visual development and in enabling the management of preventable childhood blindness. This is currently a global health-care priority [7]. A blind child potentially suffers from many more blind years than a blind adult and since about three quarters of early learning comes from vision, childhood blindness will impact greatly on education and future employment of the affected child [8, 9]. It has also been reported that blind children tend to have a high death rate [7]. Early recognition of ophthalmic congenital anomalies also aids in the diagnosis of an associated systemic disorder or disease, prevention of development of further complications and may contribute to parental counselling [8, 10-13].

Seventy five percent of blind children worldwide live in developing countries where vitamin A deficiency, measles, congenital rubella, cataract and retinopathy of prematurity are the major causes of blindness [7, 14]. However, as vitamin A supplementation and immunizations against measles and rubella are being implemented in developing countries in order to reduce the incidence of blindness in these regions, childhood visual impairment and blindness as a result of other congenital anomalies like congenital cataract, microphthalmos, anophthalmos, coloboma and infantile glaucoma, will become prominent causes of childhood blindness [8, 13, 15].

Globally, the data on the aetiology of childhood blindness vary widely. Structural ophthalmic anomalies have been reported as causes of severe visual impairment and blindness (SVI/BL) ranging from 1.4% to 42.3% of cases [8, 16-18]. Incidence of ophthalmic congenital anomalies in Nigeria is not available due to lack of comprehensive national data. Most of the local studies have been case reports or case series [5, 19, 20]. However, few observational hospital based studies have reported diverse values such as 10.3%, 21.0% and 1.7% as local prevalence of congenital ophthalmic anomalies [12, 21, 22] or a rate of 7 cases per year [23]. Nevertheless, there was no consensus among these local studies on the commonest ophthalmic congenital anomaly as congenital cataract and buphthalmos were reported variously to be the commonest type of congenital ophthalmic anomaly [22-24].

This study was conducted to document the pattern of congenital ophthalmic anomalies and their associated systemic anomalies using data from the largest tertiary hospital in Nigeria as a preliminary baseline for much-needed national data, which will be valuable in the planning of prevention strategies for childhood blindness.

Materials and methods

This was a retrospective cross-sectional study conducted at the University College Hospital, Ibadan, over a five-year period from January 2009 to December 2013.Hospital registers of the following units/departments were reviewed: ophthalmology, neonatology, paediatric neurology, cleft clinic, paediatric surgery, and radiology. Children with congenital ophthalmic anomalies were enrolled into the study. An ophthalmic congenital anomaly was defined as any structural abnormality, present at birth, which involved the eye and/or its adnexae.

Data was retrieved from case notes of patients using a predesigned proforma. Specifically, the following information was obtained: demographic data, type of ophthalmic anomaly and presence of associated systemic anomalies. The records of children who had been seen in more than one unit/department of the hospital were harmonized to avoid duplication of data.

Dual data entry was achieved using Epi Data version 3.1 for ease of data verification and consistency checks. Final data cleaning and analysis was performed using IBM® SPSS version 21.

Results

A total of 248 children were identified to have ophthalmic congenital anomalies during the study period. Their mean age at presentation was 3.9 (± 6.8) years. The median age was 1.2 years with an interquartile range of 4.6 years. One hundred and twenty eight children (51.6%) presented after their first birthdays (Figure 1). The male to female ratio was 1.27:1.

There was a positive history of consanguineous marriage between the parents of one

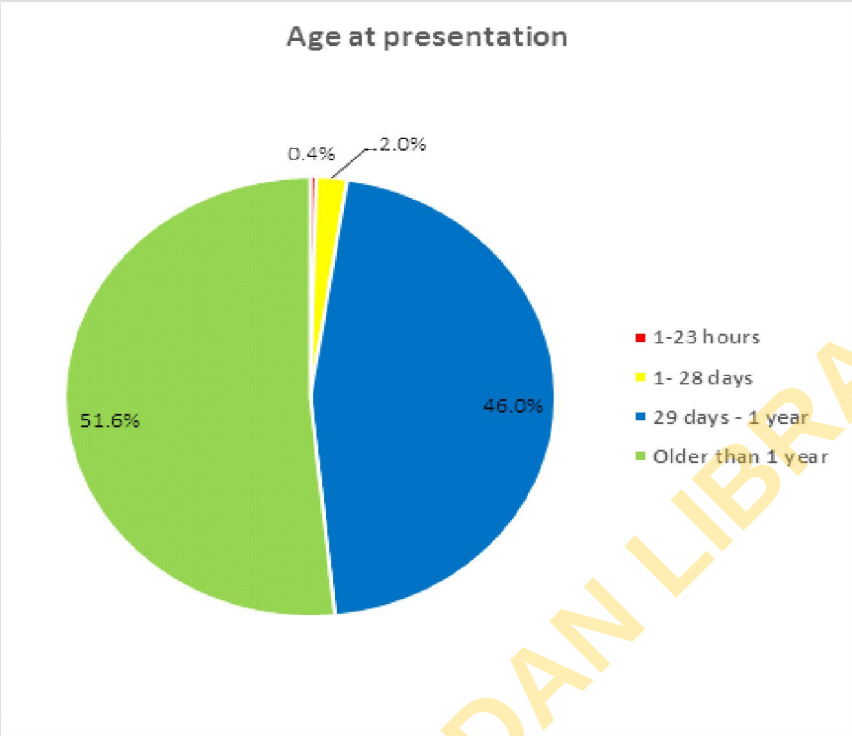

Fig.1: Age at presentation of 248 children with ophthalmic congenital anomalies

(0.4%) of the patients. Ten (4.1%) children were products of multiple gestations. Eighteen (7.9%) children had a positive history of congenital anomalies in the family.

There were a total of 259 ophthalmic congenital anomalies identified among the 248 children. The frequency distribution of the various types of ophthalmic congenital anomalies is presented in table 1. Congenital cataract was the most common, found in 109 (44.0%) patients.

Associated systemic congenital anomalies were observed in 32 (12.9%) patients. Six (2.4%) patients had multiple associated systemic anomalies involving three different systems; five (2.0%) were found to have associated systemic anomalies involving two different systems, and 21(8.5%) had a single associated systemic anomaly.

The systemic classifications and the specific associated congenital anomalies are shown in table

Table 1: Types of ophthalmic congenital anomalies seen in 248 children

Ophthalmic congenital anomalies	Frequency	Percentage (%)
Congenital cataracts	109	42.1
Congenital glaucoma	40	15.4
Microphthalmos / Anopthalmos (Whole globe anomalies)	18	6.9
Aniridia	7	2.7
Congenital corneal opacity	19	7.3
Congenital nasolacrimal duct obstruction	7	2.7
Strabismus	22	8.5
Oculocutaneousalbinism	10	3.9
Retinal abnormalities	4	1.5
Colobomas	2	0.8
Lid abnormalities	3	1.2
Orbital abnormalities	5	1.9
Other corneal abnormalities	2	0.8
Others	11	4.2
Total	259	100%

2. Thirteen (5.2%) patients had associated cardiovascular anomalies.

Children who had congenital cataracts were more likely to have multiple associated systemic anomalies ($p<0.005$, see Table 3). Furthermore, all the children who had associated cardiovascular anomalies had congenital cataracts ($p= 0.001$ see Table 4); and all the children with presumed congenital rubella infection also had congenital cataracts ($p<0.005$, see Table 5). A total of 98 (39.5%) of the children underwent surgical intervention; of which 68 (69.4%) had cataract surgery and 19 (19.4%) patients had surgery for congenital glaucoma.

Discussion

This study collected and analyzed data from a fairly wide variety of sources within one large tertiary hospital in a large sub-Sahara African developing country. This multidisciplinary perspective of the study is likely to have facilitated the recruitment of the majority of the patients that would have presented to any unit of our hospital with any form of ophthalmic congenital anomaly. As a matter of fact, to the best of our knowledge, our study population of 248 patients over 5 years, and that in a hospital-based retrospective study, is the largest to date among previous studies on ophthalmic congenital anomalies in the country.

Table 2: Systemic anomalies associated with ophthalmic congenital anomalies among 248 children

System	Frequency (%)	Specific anomalies (Number of cases)
Cardiovascular system	13(5.2)	VSD* (10), PDA#(5)†
Central nervous system	6(2.4)	Microcephaly(6)
Craniofacial anomalies	7(2.8)	
Endocrine & genetic system	5(2.0)	Down syndrome(4), Marfan syndrome(1)
Musculoskeletal system	1(0.4)	
Congenital infections	8(3.2)	Presumed Rubella syndrome (8)
Ear, nose and throat	2(0.8)	Congenital auricle defect(1), Hearing loss(1)

**VSD = Ventricular septal defect;*
#PDA = Patent ductus arteriosus
† Two patients had a combination of PDA and VSD

Table 3: Association between type of ophthalmic congenital anomaly and occurrence of multiple systemic anomalies

Type of ophthalmic anomaly	Number (%) of associated systemic anomalies None	1	2	3	Chi-square	P-value
Congenital cataracts	85(78.0)	14(12.8)	4(3.7)	6(5.5)		
Congenital glaucoma	39(100.0)	0(0.0)	0(0.0)	0(0.0)		
Whole globe abnormalities	10(62.5)	6(37.5)	0(0.0)	0(0.0)	47.070	<0.005*
Congenital corneal opacity	14(100.0))	0(0.0)	0(0.0)	0(0.0)		
Strabismus	21(95.5)	1(4.5)	0(0.0)	0(0.0)		
Others	47(97.9)	0(0.0)	1(2.1)	0(0.0)		

**Likelihood Ratio Test*

Table 4: Association between occurrence of cardiovascular anomalies and the occurrence of congenital cataracts among patients with ophthalmic congenital anomalies.

Variables	Cardiovascular system No	Yes	Chi-square	P-value
Congenital cataracts				
No	139(100.0)	0(0.0)	17.495	<0.005
Yes	96(88.1)	13(11.9)		

Table 5: Association between occurrence of congenital infections and the occurrence of congenital cataracts among patients with ophthalmic congenital anomalies

Variables	Congenital Infections		P-value
	No	Yes	
Congenital cataracts			
No	139(100.0)	0(0.0)	0.001*
Yes	101(92.7)	8(7.3)	

*Fisher's Exact Test

The age range of the patients in this study agrees with most previous studies. Only a small number of the children in the study presented within the neonatal period, while the greater proportion presented after the age of 1 year. This is similar to the findings of retrospective studies on ophthalmic congenital anomalies from Southeast Nigeria [23], and Ghana [25]. On the other hand, two other retrospective studies, one from Lagos, Southwest Nigeria [26] and the other from Cameroon [27], reported that majority (70% and 72%) of their patients presented within infancy. The reason for this difference between these studies is not immediately clear but may be related to the shorter duration in the Lagos study, as well as a marked difference between the pattern of congenital anomalies described in the Cameroon study and the present one. Further research using a prospective study design is necessary to establish the pattern of the age at presentation of patients with ophthalmic congenital anomalies in the West African sub-region.

The presentation after infancy in more than half of our patients portrays a tendency towards late presentation especially since the anomalies were present from birth. Such late presentation may be as a result of delayed detection of the anomaly by the parents and/or health care providers, particularly, with the lack of well-organized neonatal screening programmes for ophthalmic congenital anomalies in Nigeria. Alternatively, late presentation may occur despite early detection by parents and early presentation to primary health care centres because inappropriate information and counselling are given to the parents at such centres; for example parents may be told that 'the anomaly would resolve spontaneously' or 'the child is still too young for definitive treatment'.

The issues with late presentation among children with ophthalmic problems have been reported previously [28, 29]. Late presentation has a significantly negative impact on the outcome of treatment and visual development of the child. Indeed, for certain anomalies such as congenital cataract and congenital glaucoma, early diagnosis and treatment are vital to achieving optimal treatment outcome [30]. Therefore, the need for the establishment of screening programmes and surveillance systems for congenital anomalies cannot be overemphasized.

The slight male preponderance observed in our study is in consonance with a number of previous studies [22, 23, 27]. On the contrary, a few other studies have reported a female preponderance for ophthalmic congenital anomalies [26, 31-33]. Notwithstanding, it appears that there is no gender predilection for congenital anomalies, on the whole [26].

Congenital cataracts accounted for almost half of the ophthalmic congenital anomalies in this study, while congenital glaucoma was the second commonest anomaly. This pattern is similar to the findings of five out of six previous Nigerian studies [12, 23, 24, 26, 34]. The study with a different pattern reported that congenital glaucoma was the commonest (38%) closely followed by congenital cataract [22]. All these studies are similar to the present study in that they are hospital-based retrospective studies conducted in university teaching hospitals. However, a striking feature of the latter study, with the differing pattern, is that it is the only study from northern Nigeria. Thus, the difference in frequency distribution might be as a result of geographical variation in the incidence of the different types of ophthalmic congenital anomalies. Further research using a multi-centre study design will be useful in clarifying this variation.

When compared with two similar studies from other countries in West Africa, our finding regarding the frequency of congenital cataract is counterpoised. Actually, the frequency distribution of the anomalies described in this study is similar to the study from Ghana [25] but it is remarkably different from the Cameroon study, which found that the commonest anomaly was congenital nasolacrimal

duct obstruction (CNDO) in 66.7% of their patients [27]. CNDO was much less common in our patients (2.7%) and was the third commonest after cataract and glaucoma in some other Nigerian studies [12, 22, 24]. The difference may be due to dissimilarity in the study settings. The Cameroonian study was conducted in the ophthalmic unit of a Gynaecology, Obstetrics and Paediatrics Hospital, which may be somewhat limited in the range of patients seen while the Nigerian and Ghanaian studies were conducted in university teaching hospitals.

Moreover, the pattern of ophthalmic congenital anomalies in Europe, North America and Asia appears to be different from that of the West African reports including the present study. Most of the studies from the developed countries observed that whole globe anomalies such as microphthalmos and anophthalmos were the more common forms of eye birth defects [31, 35, 36]. On the other hand, these anomalies are reported much less frequently in the West African studies. Less than 10% of the children in this study had microphthalmos or anophthalmos. This difference in the pattern is likely to be a reflection of the higher incidence of rubella infection and consequently rubella cataracts in developing countries compared to developed countries [37]. It may also be due to the difference in study methods. Most of the studies from Europe and North America were large population-based studies in which data was obtained from birth registries and birth defect surveillance programmes, whereas all the West African studies were retrospective and hospital based.

In this study, approximately one-eighth (12.9%) of the patients had associated systemic anomalies. This is comparable to the study by Chuka-Okosa *et al* [23] from southeastern Nigeria that reported 9.3%. Our finding, however, is much lower than the European studies by Stoll *et al* (53.8%) [32] and Bermejo *et al* (78.9%) [35]. This dissimilarity may also be explained by the differences in the study methods as well as by the possibility for better detection of systemic anomalies with active surveillance of birth defects in the European countries. This buttresses the need for the setting up of such screening programmes in the Nigerian health care system.

The systemic anomalies associated with ophthalmic congenital anomalies, in our study, were more commonly found in the cardiovascular system. This is contrary to the report by Chuka- Okosa *et al* [23], who found deafness and cleft lip to be the most prevalent associated systemic anomalies. The explanation for this difference is not clear especially as the pattern of the ocular anomalies observed in the two studies is similar. A possible reason might be the difference in the number of patients studied, 248 in our study compared to 54 in theirs.

Likewise, our finding that cardiovascular anomalies were the commonest systemic association does not echo the findings of the European studies cited earlier [32, 35]. In Bermejo *et al's* report [35], limb anomalies were the commonest systemic association while cardiovascular anomalies ranked eighth in the frequency distribution. In Stoll *et al's* study [32], facial dysmorphia was the commonest association and cardiovascular anomalies were the third commonest. This difference in pattern of systemic association may be explained by the differences in the pattern of ocular anomalies reported in their studies compared to the index study. Congenital cataracts especially those secondary to intrauterine rubella infection are commonly associated with cardiovascular anomalies.

There are a few limitations faced by this study. These include the retrospective nature of the study, the possibility of missing/incomplete records and the lack of information on the incidence and risk factors of ophthalmic congenital anomalies. In addition, the fact that it is a hospital-based study hinders its extrapolation to the general population. Furthermore, the lack of genetic and chromosomal analysis of the identified patients restricted the classification of patients and proper diagnosis of syndromes among them.

Nonetheless, the strengths of this study lie in its multidisciplinary nature of data collection, which ensured a fairly large data pool, and is likely to have had a positive impact on the detection of systemic associations. Secondly, among the Nigerian studies, our study has the largest number of patients. Thus, we believe this report is a fairly accurate representation of the pattern of ophthalmic congenital anomalies seen in Nigerian tertiary hospitals.

In conclusion, this study has demonstrated that the commonest ophthalmic congenital anomaly presenting for tertiary care in Ibadan is congenital cataract. It also shows that cardiovascular anomalies are the commonest systemic association of eye malformations especially congenital cataract. We advocate for the establishment of a registry for congenital anomalies with effective screening and active surveillance in our health system. This would generate much needed data on the epidemiology of congenital anomalies including ophthalmic anomalies in our population.

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