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Prevalence of Congenital External Ear abnormalities among Deaf Pupils in Kaduna Metropolis, Kaduna-Nigeria

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Abstract

Background: Approximately 5% of the general population have some sort of ear defect. There is limited knowledge on congenital external ear abnormalities among deaf pupils in Northern Nigeria and the country at large.

Patients and Methods: A cross-sectional study with a control population which assessed the prevalence of congenital external ear abnormalities among deaf pupils in Kaduna metropolis. Deaf pupils from two schools for the deaf were recruited for this study from November 2016 to August 2017. The pupils had screening audiometry done to ascertain their hearing thresholds. Data was collected using questionnaires in a multi-staged sampling fashion. The generated data was analysed using Statistical product and service solutions (SPSS) for windows version 20.

Results: A total of 430 subjects with equal number of controls participated in this study. The mean age for the subjects and controls were 13.48 ± 2.36 and 13.08 ± 1.81 respectively. The male:female ratio for the subjects was 1.29:1. Ninety three out of the 430 subjects had ear abnormality, giving a prevalence of 21.6%. The most common major anomaly in the subjects were external auditory canal atresia 3 (0.7%) and congenital absence of the tragus 3 (0.7%) while microtia 7 (1.6%) was the most common major abnormality in the controls. There was a slight preponderance of left sided abnormalities in both groups. Thirty four subjects (7.9%) had major abnormalities. The most common minor abnormality was pre-auricular sinus in 37 (8.6%) of 63 subjects, Overall, sixty two subjects (14.4%) had minor abnormalities, (p=0.001).

Conclusion: Prevalence of congenital external ear abnormality was higher among the deaf compared to the general population. Pre-auricular sinus was the most frequent congenital external ear abnormality among the participants and there was a slight left sided preponderance.

Keywords: External ear abnormalities; Congenital; Deaf pupils; Kaduna

Introduction

The external ear consists of the pinna and the external auditory canal. Approximately 5% of the general population have some sort of ear defect [1]. Protrusion of the external ear is the most commonly encountered congenital external ear abnormality [2]. In a study conducted by the Mainz congenital birth defect monitoring system, external ear anomalies of all types, including deformations in foetal constituents were found in 19% of all newborns [3]. Congenital external ear anomalies usually affect the right ear, and majority of them are unilateral [4-6]. Malformations of the external ear can involve the orientation, position, size and relief pattern of the pinna; anotia may also occur. Anterior to the pinna, ear tags, ear sinus and ear pits may be found. The external auditory canal can be atretic (aplastic) or hypoplastic [4,7].

In a study conducted by Ibekwe and Ogechi [8] in Port Harcourt Nigeria where profiling of paediatric ear nose and throat diseases was done, congenital external ear abnormalities constitute 1.1% of the total number of cases. Marion and Gloria [9] found that external ear abnormalities especially pre-auricular sinuses, were four times as common in the black as in the white population.

External ear abnormalities may be associated with deafness especially in syndromic subjects [4]. Such associations include the CHARGE association. Deafness is a hidden handicap, or the unseen disability and is a global problem [10,11]. During evaluation, Computed tomographic (CT) scans and diffusion-weighted Magnetic resonance imaging (MRI) are indispensable tools for proper diagnosis of external ear abnormalities such as masses on the external ear [12] external auditory canal atresia and other associated congenital ear abnormalities such as dehiscence of the petrous apex [13] and congenital cholesteatomatous lesions. Razek et al. [14] in a study to assess the role of diffusion-weighted MRI in assessing external ear masses, and in another study to compare computed tomographic scan and MRI in patients with cholesteatoma, they documented a perfect agreement in the sensitivity of CT scan to detect complications caused by cholesteatoma, however, suggested that diffusion-weighted MRI will be superior in detection of soft tissue abnormalities. The study aimed to determine the prevalence of congenital external ear abnormalities among deaf pupils in Kaduna metropolis, Kaduna.

Participants and Methods

Kaduna metropolis is located within the guinea savannah with coordinates latitude $10^0$31' 23^0N, longitude $7^0$26' 25^0E. The population of Kaduna metropolis during the 2006 population census was 1,139,578 with an estimated annual growth of population of 2.53% [15].

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Multi-staged sampling method was used to enroll 430 deaf pupils. Deaf pupils from the schools for the deaf on Ilorin road off Katsina road Kaduna and along Ali Akilu Way Kawo Kaduna were recruited for this study. One hundred and eight pupils were selected from the Demonstration school for the deaf and 322 pupils were selected from the government-owned school in a multi staged fashion. An equal number of normal pupils matched for age and gender were enrolled from private and government-owned primary and junior secondary schools to serve as controls. Ethical clearance was obtained from relevant bodies. Informed consent/assent was obtained from parents/pupils. A structured pre-tested questionnaire was used to generate data on demography and history. A full ear examination was carried out, audiometric evaluation conducted and the findings documented. Pure tone audiometry was conducted with an audiometer with model Graphic Digi IS Clinical Audiometer by Vansari Marketing Services, India, at frequencies of 250 Hz–8K Hz for air conduction and 500 Hz–4 KHz for bone conduction.

The generated data was coded, entered into Statistical product and service solutions (SPSS) for Windows, version 20 and statistical analysis (chi square test and student's t test) was conducted. P value set at $p<0.05$ as significant.

Results

Four hundred and thirty pupils from the two deaf schools were recruited and an equal number of pupils were recruited from regular schools (primary schools and junior secondary schools) within Kaduna metropolis. The mean age of the subjects was 13.48 ± 2.36 years, minimum age was 8 years and maximum age was 17 years while in the control population, the mean age was 13.08 ± 1.81 years. The minimum age in the control population was 7 years of age and the maximum age was 17 (Table 1).

Ninety three out of the 430 subjects had congenital external ear abnormalities giving a prevalence of 21.6%, while 43(10.0%) out of the 430 controls had congenital external ear abnormalities. The difference was statistically significant (x^2=93.000, p=0.031).

Abnormalities were seen in 58 male subjects (13.5%) while abnormalities were seen in 35 female subjects (8.1%). The difference was not found to be statistically significant (X^2=2.870, N=430, p=0.067).

On the right side, the external ear abnormalities among both the subjects and the control group are as presented in Table 2. There was higher frequency of abnormalities among the subjects compared to controls. Forty six (10.7%) subjects had right sided abnormality compared to 25 (5.8%) controls. The difference was found to be statistically significant (X^2=73.000,N=430, p=0.001).

	Subjects		Controls	
Grouped Age (Years)	**Frequency**	**Percentage**	**Frequency**	**Percentage**
6 – 9	13	3	5	1.2
10 – 14	271	63	330	76.7
15 – 17	146	34	95	22.1
Total	430	100	430	100
Gender				
Males	242	56.3	242	56.3
Females	188	43.7	188	43.7
Total	430	100	430	100
P=0.875				

Table 1: Age and gender distribution of participants.

	Subjects		Controls	
Abnormalities	**Number of Ears**	**Percentage**	**Number of Ears**	**Percentage**
Microtia	19	2.2	13	1.5
Macrotia	16	1.9	6	0.7
Anotia	3	0.3	0	0
Preauricular Tag	6	0.7	5	0.6
Preauricular Sinus	36	4.2	18	2.1
Absent Tragus	6	0.7	0	0
Absent Ear Lobe	2	0.2	0	0
Duplicated Tragus	2	0.2	0	0
Low Set Pinna	4	0.5	1	0.1
Canal Atresia	6	0.7	0	0
Cauliflower Ear	0	0	1	0.1
Normal	763	88.7	817	95
Total	863		861	

NB: Some ears have more than one abnormality

Table 2: General overview of congenital external ear abnormalities among the participants.

Forty eight subjects (11.2%) had abnormalities on the right ear compared to 57 (13.3%) on the left ear. There was no significant statistical difference between the left and right ears of the subjects based on the presence of congenital external ear abnormalities (p=0.644) while 16(3.7%) of the controls and 12 (2.8%) of the controls had abnormalities on the right and left ears respectively. There was no significant statistical difference between the right and left ears among the controls (p=0.412).

Thirty four subjects (7.9%) had major abnormalities whereas 14 of the controls (3.3%) had major congenital external ear abnormalities. This was not found to be statistically significant (X^2=6.000,N=430,p=0.112).

Of the major abnormalities the most common in the subjects was external auditory canal atresia 3(0.7%) and congenital absence of the tragus 3 (0.7%) while microtia 7 (1.6%) was the most common major congenital external ear abnormality in the control group.

Sixty two subjects (14.4%) had minor congenital external ear abnormalities whereas 30 controls (6.9%) had minor congenital external ear abnormalities. This was found to be statistically significant (X=20.278,N=430 p=0.016). The most common minor congenital external ear abnormalities was pre-auricular sinus seen in 37 (8.6%) of subjects and 18 (4.2%) of controls.

Discussion

The presence of one congenital abnormality should raise suspicion of the presence of other coexisting abnormalities. Many pupils attending the deaf schools commonly have congenital deafness; this morbidity may be compounded by the presence of other congenital abnormalities such as external ear abnormality, which could constitute cosmetic deformity. These deformities are potentially surgically correctable if recognized; otherwise affected pupils may be subjects of mocking and ridicule which could worsen their social isolation. There is paucity of data regarding congenital external ear anomalies in deaf pupils and most studies of congenital external ear anomalies targeted a more general population.

This research studied a population of deaf pupils with a view to identifying presence of external ear abnormalities. This study found age of subjects in school for one-third of deaf pupils to be fifteen years or older compared to a younger age of the control group. The observed older age of school enrolment among the deaf pupils could be attributed to parental delays from anticipation that the child may regain auditory function and be enrolled in to normal schools.

In this study, congenital external ear abnormalities were found to be almost twice in prevalence amongst deaf pupils compared to normal pupils in Kaduna metropolis. A prevalence of 21.6% was observed among the deaf pupils. The prevalence of abnormalities of 10.0% found among normal pupils in this study was in agreement with the findings of Bartel [16] who reported that based on various geographical locations, prevalence of congenital external ear abnormalities ranged between 0.83-17.4 per 10,000 births. Similarly, Manstein and Narayan [1] found that 5% of the general population had some sort of congenital external ear abnormalities, which may range from abnormality of shape to even complete absence of the pinna. The finding in this study was however noted to be higher than that documented by other researchers. Adhikari et al. [11] found the prevalence of congenital external ear abnormalities among school going children in Nepal to be 1.36%. It is worthy of note that congenital abnormalities tend to be multiple in affected individuals, hence a study that focuses on targeted population with a congenital abnormality will invariably record higher incidence of any other anomaly been studied compared to the general population. Bijan et al. [17] in a hospital based study, reported a prevalence of congenital external ear abnormalities of less than 1% in the general population. Both Manstein and Bijan studies were on the general population including adults, whereas this study only focused on school pupils, this may partly explain the higher prevalence rate of the abnormalities in this study.

Saikia and Bordoloi [18] however had a contrary finding of female preponderance in a plastic surgery unit of an Indian hospital, Assam with the females accounting for 64% of the children with congenital external ear abnormalities. Female predominance could be attributed to cosmesis seeking behavior of the female gender more than the male counterpart. However, a study conducted by Bijan et al. [17] did not find any gender predominance.

The most prevalent congenital external ear abnormality among the deaf pupils was pre-auricular sinus; this was slightly more common in the left ear. The prevalence of preauricular sinus among the deaf pupils was almost twice that of the control group. This was statistically significant. Iseh et al. [19] in Ibadan Nigeria similarly found preauricular sinus as the commonest congenital external ear abnormality among patients attending the Otorhinolaryngologic clinic in Ibadan Southwestern Nigeria. Charles et al. [20] found the prevalence of preauricular sinus to be 2.4%. The significance of this observation whereby preauricular sinus was the predominant congenital external ear abnormality among both the subjects and the controls means that the abnormality is very common in the general population and few may require surgical correction. Huang et al [21] in a cohort survey in Singapore found that 43% of the subjects studied had predominantly right sided pre-auricular sinus while 57% had preauricular sinuses involving their left ears.

Similarly, in the Malaysian population, Tang et al. [22] found left sided preponderance of 60.6% among the subjects studied. In Vancouver Canada, Charles et al. [20] found 73.1% of the cases being unilateral involvement while 26.9% of the subjects had bilateral pre-auricular sinus. In contrast to the findings in this study, Jeffrey et al [23] and Paulozzi and Lary [24] found right sided predominance of pre-auricular sinus. Jeffrey et al [23] reported that subjects with bilateral pre-auricular sinus usually have a close relative with pre-auricular sinus. In contrast, Sanjeev et al [25] in Nepal and Adhikari [10] in Kathmandu valley Nepal, in their studies did not find preauricular sinus to be the most common congenital external ear abnormality among school going children in their locality.

Microtia was the most common major congenital external ear abnormality among the control group in this study. It was not a common abnormality among the deaf pupils in this study, rather it was more common among the control group. It appears to be rare as Iseh et al. [19] found a single patient with microtia in their study. Adhikari [10] in Nepal found only 0.3% of school going children with microtia. There was slight male predominance in both the subjects and controls. Souradeep [26] documented slight male predominance and also reported equal affectation of both the right and left ears in the subjects he studied. Similarly, Luquetti et al. [27] in Brazil, found slight male predominance (56.6%) but right sided predominance of 65.6% in live births with microtia in a 29 year period review. Right sided predominance seen in this study was similarly reported by Jeffrey et al [23] and Elisabeth and Robert [28]. Macrotia was seen more among the deaf pupils compared to the controls. Macrotia was diagnosed when the total ear height was more than 66 mm in children [29,30]. Macrotic ears can lead to emotional stress with a decline in the patient's health related quality of life, they may also negatively affect school performance in children and job performance in adults. In all the participants, macrotia was bilateral. Macrotia can be surgically corrected through otoplasty. Wilfred and Godfrey [31] in Zimbabwe found male predominance regarding macrotia but there was no side predilection. Similarly, Iseh et al. [19] in Ibadan Nigeria found 3.3% of the patients reviewed with macrotia. Jeffrey et al. [23] documented unilateral involvement as 3-5 times bilateral involvement. However, in this study, bilateral involvement was the rule among both the deaf pupils and the control population. A few cases of stenotic external auditory meatus were seen in this study. Three cases of bilateral isolated atretic external ear canal was seen in the subjects. The incidence of congenital external auditory canal atresia ranged between 1 in 10,000 live births to 1 in 20, 000 live births [21,30]. Souradeep [26] found that almost 75% of subjects with microtia had associated congenital external auditory canal atresia of varying degree. Iseh et al. [19] in Ibadan Southwestern Nigeria found meatal atresia associated with microtia in 10 patients and isolated cases of meatal atresia in 2 patients. Minor abnormalities constituted 67.4% of total abnormalities seen among the participants in this study. Laszio et al. [32] in Hungary found minor aplasias as the most predominant finding among Hungarian children.

Conclusion

The prevalence of congenital external ear abnormalities among deaf pupils in Kaduna metropolis was 21.6%. Pre-auricular sinus was the most common minor abnormality encountered in both the deaf pupils and the normal pupils. Canal atresia and absence of the tragus were the most common major congenital external ear abnormalities in the deaf pupils.

Conflict of Interest

None

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