World Journal of Medical Sciences 9 (4): 267-272, 2013
ISSN 1817-3055

DOI: 10.5829/idosi.wjms.2013.9.4.81171

Childhood Hearing Loss-A Nigerian Experience and a Call to Action

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Abstract: The burden of childhood hearing loss is huge, its effect on affected children devastating and the economic toll is heavy. Unfortunately much attention is not given to programs that promote early detection, management and rehabilitation of such children in developing countries. A cross-sectional study of the prevalence and patterns of hearing loss was undertaken among 127 children aged 5-15 years who presented for hearing assessment in two ear clinics in south-western Nigeria. Results revealed that majority (72.5%) of the children were confirmed as having hearing loss and 90.2% of those with hearing loss had disabling hearing loss. Conductive hearing loss was rampant but sensorineural hearing loss was the most prevalent. Although the flat audiogram and the flat tympanogram (Type B) predominated, other patterns of tympanograms and audiograms were also found. In conclusions, in developing countries there should be stronger advocacy by health workers for programs that will empower them and others who work with children to identify and refer children with hearing loss promptly. Universal screening of newborns and children should be made mandatory and programs aimed at preventing conditions and infections that can lead to childhood hearing loss should also be prioritized and strengthened as a matter of urgency.

Key words: Childhood Hearing Loss · Disabling Hearing Loss · Early Detection · Rehabilitation

INTRODUCTION

The importance of hearing is grossly underestimated. Helen Keller, blind and deaf, emphasized the importance of hearing by saying "Blindness separates people from things, but deafness separates people from people"[1]. The origin of these words has also been ascribed to Immanuel Kant, eighteenth century German Philosopher"[2]. The extreme isolation described by these words is particularly relevant to children, who need to interact with people for normal and optimal development. Without early intervention children with hearing loss are condemned to a life of deprived language and cognitive development, restricted literacy, poor academic and vocational outcomes, personal-social maladjustments and emotional difficulties [3, 4]. Childhood onset hearing loss also has significant implications for long-term economic costs. It has been suggested that the global burden of disease for childhood hearing loss may be significantly higher than for adult-onset hearing loss [5, 6] which currently ranks third on the global causes of years lived with disability (YLD) index and 15th on the disability adjusted life-years (DALY) index (one of four non-fatal conditions among the 20 leading contributors to the global burden of disease) [7, 8].

According to the World Health Organization, of the 360 million people (over 5% of the world's population) affected by hearing loss, about 32 million are children [9]. If milder cases of hearing loss are included, almost 10% of the world population are affected by hearing loss making it the most prevalent disabling condition globally [7, 10-12]. It is estimated that childhood hearing loss constitutes approximately 25% of this global burden and significant hearing loss is present in 1 to 6 per 1000 newborns [7]. To mitigate the effects and burden of disease in children many programs have been instituted in many places worldwide This includes the universal Newborn Hearing screening which has been successful in much of the developed world [13-15].

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In Nigeria, studies have suggested that the prevalence of hearing loss in school-aged children ranges between 6.7 and 8.9%, although these studies were confined to specific age groups or geographical areas [16]. It is also estimated that 6000-27,000 babies with permanent congenital and early-onset hearing loss (PCEHL) will be born in Nigeria annually and about 5000-22,000 of these will live beyond five years of age [17]. Unfortunately, more than 90% of infants in developing countries still do not have access to early identification of hearing loss [13-15]. This problem is compounded by paucity of data to facilitate planning and to deal effectively with this complex problem. This study therefore examined the prevalence and patterns of hearing loss among the children who presented for hearing assessment in the ear clinics of the University College Hospital, Ibadan, Nigeria and LAUTECH Teaching Hospital, Osogbo, two teaching hospitals that serve much of south-western Nigeria.

MATERIALS AND METHODS

This was an institutionally approved cross-sectional study of children presented for hearing assessment. A minimum sample size of 125 was determined and 127 consecutive patients who matched inclusion criteria in study institutions were recruited into the study. They included all children between the ages 5 and 15 who presented for hearing assessment and were able to cooperate with the test procedures but excluded those with discharging ears and those with congenital ear malformations like absence of the ear canal. Calibrated audiometers were used to determine the pure tone audiometric thresholds in a sound-proof booth and tympanometers (also calibrated) for the impedance testing of the ears. These procedures were carried out by certified audiologists on both ears in each patient. The test results for pure tone audiometry were configured (charted) on audiograms (graphs of intensity against frequency of sound) and the degree, type and pattern of hearing loss were noted. Tympanometry results were also charted on tympanograms, graphic representations of the relationship of external auditory canal air pressure to impedance and the type (classified on the basis of the configuration as Type A, Type AD, Type AS, Type B and Type C) was noted for each patient. Data entry, cleaning and analysis were done with the Statistical Package for the Social Sciences (SPSS) version 15. Data analysis was univariate (proportions, means and standard deviations, medians and ranges) and results were presented as frequency distributions.

RESULTS

A total number of 127 children (75 from LTH and 52 from UCH) was studied. The Male: Female ratio was 1.2:1. The ages of the children ranged from 5 to 15 years. Mean age was 10.2 years (Standard deviation= 2.94years). The age distribution was shown in Table 1. Table 2 shows the diagnostic profile of all the patients studied. There was a wide range of diagnoses entertained. The list included problems of the ears as well as problems of the nose and throat. The range of pathology included congenital, inflammatory as well as neoplastic problems.

Tables 3 and 4 show the degrees of hearing loss exhibited by subjects' ear. Table 3 shows the distribution according to the severity of hearing loss while Table 4 shows the distribution according to the presence or absence of disability. Slightly more than a quarter (27.5%) of the assessed children had normal hearing, 64.6% of right ears exhibited hearing loss and 53.5% of the left ears had hearing loss. This means that 64.6 % of the children tested had hearing loss in at least one ear. Disabling hearing loss was found in 56.7% of right ears and 47.2% of left ears. Overall, 90.2% of those who had hearing loss had disabling hearing loss.

Table 1: Age distribution of the studied subjects

Age (Years)	Frequency	Percent
5-10 years	64	50.4
11-15 years	63	49.6
Total	127	100.0

Table 2: Diagnostic profile of studied patients

Diagnosis	Frequency	Percent
Chronic Suppurative Otitis Media	26	20.5
Nasal blockage	7	5.5
Post measles hearing loss	6	4.7
Adenoid enlargement	4	3.1
Mental retardation	2	1.6
Hard of hearing	45	35.4
wax impaction	10	7.9
Otalgia	8	6.3
Cerebellopontine angle cyst	1	0.8
Cerebral palsy	1	0.8
Congenital hearing loss	5	3.9
Chronic non suppurative otitis media	1	0.8
Sudden hearing loss	3	2.4
Eustachian tube dysfunction	1	0.8
Microtia	1	0.8
Road traffic accident	2	1.6
Post nasal space mass	1	0.8
Bloody otorrhoea	1	0.8
Cleft palate	1	0.8
Cranofacial abnormality	1	0.8
Total	127	100.0

Table 3: Profile of Severity of Hearing Loss in examined ears

Degree of Hearing Loss	Frequency	Percent
Right Normal Hearing	45	35.4
Mild	18	14.2
Moderate	13	10.2
Moderately-severe	30	23.6
Severe	12	9.4
Profound	9	7.1
Total	127	100.0
Left Normal Hearing	59	46.5
Mild	15	11.8
Moderate	11	8.7
Moderately-severe	17	13.4
Severe	11	8.7
Profound	14	11.0
Total	127	100.0
Both Both Ears Normal	35	27.5
At least Mild Loss in Both Ears	57	44.9
Only Left Ear Normal	24	18.9
Only Right Ear Normal	11	8.7
Total	127	100.0

Table 4: Profile of hearing loss in examined ears (Showing presence or absence of disability)

Degree of Hearing Loss	Frequency	Percent
Right 0-25 dB (Normal hearing)	46	36.2
26-30 dB (Mild loss, not disabling)	9	7.1
>30 dB (Disabling loss)	72	56.7
Total	127	100.0
Left 0-25 dB (Normal hearing)	59	46.5
26-30 dB (Mild loss, not disabling)	8	6.3
>30 dB (Disabling loss)	60	47.2
Total	127	100.0
0Both Normal	35	27.6
Disabling	83	65.3
Not Disabling	9	7.1
Total	127	100.0

Hearing loss of both conductive and sensorineural types as well as the mixed form (combining both conductive and sensorineural types) were found in both ears. In the right ear, the most common type found (26.8%) was the conductive type, although the sensorineural type was almost as common (23.6%). In the left ears, the sensorineural type was the commonest type, the proportion (27.6%) almost doubling that for conductive hearing loss (15%) (Table 5).

Table 6 shows the audiometric patterns that were found. Apart from the normal pattern that was found in the normal ears, the predominant pattern for both ears was the flat type. The trough and peak types were also frequently encountered though not as commonly. Other known patterns of audiograms were also found. A few audiograms did not meet the criteria for inclusion in any other category. Table 7 shows the distribution

Table 5: Types of hearing loss

Types of Hearing Loss	Frequency	Percent
Right Normal	45	35.4
Conductive	34	26.8
Sensorineural	30	23.6
Mixed	18	14.2
Total	127	100.0
Left Normal	59	46.5
Conductive	19	15.0
Sensorineural	35	27.6
Mixed	14	11.0
Total	127	100.0

Table 6: Audiometric patterns of examined subjects

Patterns of Hearing	Frequency	Percent
Right Normal	45	35.4
Flat	35	27.6
Trough	18	14.2
Peaked	16	12.6
Notched	3	2.4
Precipitous	5	3.9
Low frequency HL	1	0.8
Others*	4	3.1
Total	127	100.0
Left Normal	58	45.7
Flat	27	21.3
Trough	16	12.6
Peaked	15	11.8
Notched	1	0.8
Precipitous	5	3.9
Others*	5	3.9
Total	127	100.0

* Criteria for inclusion in any other category not met.

Table 7: Patterns of tympanograms of examined subjects

Patttern of Tympanogram	Frequency	Percent
Right Type A-Normal	66	52.0
Type B-Flat	44	34.6
Type As-Shallow	13	10.2
Type C-ETD	4	3.1
Total	127	100.0
Left Type A-Normal	70	55.1
Type B-Flat	39	30.7
Type As-Shallow	16	12.6
Type C-ETD	2	1.6
Total	127	100.0

of the patterns of the tympanograms found. The predominant pattern for both ears was the normal pattern. Among those with hearing loss, however, the predominant pattern was the flat type.

DISCUSSION

Majority (72.5%) of the children aged 5-15 years who presented for hearing assessment in our study were sent in for a wide variety of reasons. Most of them were diagnosed as having hearing loss and in 90.2% of those with hearing loss, the loss was disabling. Although conductive hearing loss was the predominant type on the right and sensorineural hearing loss on the left, overall, sensorineural hearing loss was the most prevalent. The flat audiogram was the most common and the flat tympanogram (Type B) predominated other patterns of middle ear pathology.

A prevalence as high as we found in this study (72.5%) is much higher than those reported in literature. Some community based studies have suggested the prevalence of hearing loss among children in Nigeria ranges from 6.7 to 8.9% [16] and a prevalence of 11.3% has been given from another study [18]. Our study was conducted in an ear clinic and gave the prevalence of hearing among children presenting for hearing assessment, not the community prevalence. It is however pertinent to note that some of the previous community based studies were based on segments of the population of children, for example, children in schools [16] or pediatric clinics and may also not be correct estimates the of the true community prevalence. It is reasonable to postulate that the true community prevalence may in fact be higher that what previous studies have estimated. This is a plausible situation since in the developing world we often only observe a very small proportion of the pathology that actually exists. This so-called 'the tip of the iceberg' phenomenon is in harmony with the situation of hearing loss among children in developing countries which has been described as "a silent epidemic" and "a silent health priority"[19].

The point that we do emphasize from the high prevalence in our study is that hospitals and ear clinics in developing countries such as ours and maybe also in the developed world get to see a lot of patients with hearing loss and they need to be prepared to detect, treat and rehabilitate such patients. Governments and health authorities should also have strong primary prevention programs in place. These measures are particularly important in resource-scarce developing countries where such preparation for prevention and management of hearing loss may not be on a list of priorities. This situation is unfortunately rather paradoxical since it has been shown that economic losses from a high prevalence of hearing loss in the community is actually very high [20]. There is therefore a need for very strong advocacy to bring to light the true situation of hearing loss in our communities and to show that we could actually make economic gains on the long run if the prevention, detection, treatment and rehabilitation of hearing loss in children are paid more attention in our health programs.

Further supporting the likelihood that the prevalence figures available may be underestimating the true prevalence of hearing loss in the community is the fact that our study was conducted on children with a wide variety of diagnoses and not only on children presenting with hearing loss. Many of the patients did not complain of hearing loss. It is true that the patients presented with problems in systems that are closely associated with the auditory systems which may lead to hearing loss. But it is also true that such problems exist in abundance in the community and since the patients may not present with overt hearing loss, the hearing loss may be overlooked. It has been noted that a vast number of children in our environment do have mild hearing loss which may not be noticed and therefore may not present on time [21]. This further emphasizes the importance of vigilance and maintenance of a high index of suspicion among health workers and other professionals who deal with children so as to ensure cases of hearing loss in children as possible are readily identified. It also underscores the need for very strong ear-care programs as part of every tier of our health care systems in developing countries.

According to the World Health Organization, disabling loss in children aged 0-14 years is defined as the presence of a hearing threshold of = 31 dB in the better ear [9]. Going by this criterion, an overwhelming majority (nine out of ten) of the children in our study presented with disabling hearing loss. This very significant finding raises the volume of our alarm even higher as it suggests that the majority of the children that we see in our ear clinics with hearing loss may be children who have disabling loss. It may also mean that children with progressively worsening hearing loss do not present until the loss becomes disabling. Both possibilities have grave implications for a child. Hearing loss in children has been linked with deficits in speech and language acquisition, poor cognitive development, poor academic performance, personal-social maladjustments and emotional difficulties [3].

Yet another finding of great importance in our study is the overall preponderance of sensorineural hearing loss in the ears of the children tested. Previous studies have suggested that the conductive type of hearing loss is the commonest type of hearing loss among children [22]. Hearing loss of the conductive type is due to problems of the external and middle ears [23]. Middle ear infections are particularly common in children and if recognized can usually be successfully treated [24]. In our study, conductive hearing loss was indeed responsible for a large number of the cases, underscoring the need for programs directed at preventing and identifying such cases for early intervention. But there were more ears with sensorineural hearing loss. Sensorineural hearing loss, unlike conductive is usually irreversible and the emphasis is on rehabilitation. Permanent congenital and early-onset hearing loss (PCEHL) is also very common in children and it is of paramount importance that these cases also be detected and rehabilitated [21, 25, 26].

There is therefore evidence from literature that both types of hearing loss existed in children in large enough amounts to justify readiness for the management of both types. Unfortunately, in our environment, facilities for early and precise diagnosis are usually not available and parental suspicion prompted by a child's inappropriate or lack of response to sound is the primary mode of detection of hearing loss [21]. Unfortunately, this passive detection usually occurs at a mean age of 22 months, which far exceeds the recommended early detection threshold of three months [25] and therefore the quality of rehabilitation is affected. The implication is that for adequate childhood ear care, facilities need to be available for prompt detection, management and rehabilitation services for the two types of hearing loss.

Also worthy of note is the finding of unusual patterns of tympanograms and audiograms among the children. The predominant audiometric and tympanometric patterns found in our study were the flat types and are in keeping with what is expected for the age group [27]. However, the finding of other patterns signifies the need for thorough evaluation of children presenting with hearing loss in order not to miss out unusual causes of hearing loss.

The limitations of this study included the restriction of study subjects to children attending ear clinics and the exclusion of children below five years. The clinic-based study did not give community estimates and the subjects were not varied enough to allow for the exploration of data for variations attributable to differing characteristics of subjects. Nevertheless, our study population, being exclusively hospital patients has however, provided an opportunity to gain valuable insight into the patterns of hearing loss in this population. The exclusion of children aged less than five years, due to the fact that these children could not cooperate with pure tone audiometry instructions, leaves a gap in the data concerning children of this age group. This excluded age group is significant since children in the group are particularly vulnerable to the effects of hearing loss. Our recommendations for further studies include community based household studies and studies that utilize methods (such as auditory brainstem response audiometry and otoacoustic emissions technology) that that can be used for children under five.

In order to reduce the huge burden that hearing loss places on this special group, especially in developing countries like ours, we recommend that many more new programs be created and existing programs strengthened to empower health workers and other professionals who work with children including teachers to identify children with hearing loss and other ear diseases early and to refer them promptly.

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