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Neonatal hearing screening in a rural/sub-urban community in Nigeria, sub-Saharan Africa–A preliminary report

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ABSTRACT

Introduction: The implementation of Neonatal Hearing Screening (NHS) program is still at the preliminary stage particularly in developing countries despite the burden of permanent congenital and early-onset hearing impairment. There has been an earlier report of NHS in a city in Nigeria, however, this is a report of a preliminary NHS carried in a rural/sub-urban area in Nigeria.
Method: This prospective study, which took place between October 2009 and April 2010, involved all newborns delivered at the University College Hospital, Ibadan and the Bilal Missionary Maternity, Agodi, Ibadan, a small maternity service located in Agodi community serving predominantly low socioeconomic class people. All the neonates delivered during the study period were included in the screening. The screening was performed within 72 h of delivery using automated auditory brainstem response (AABR) and repeated after 6 weeks among those with referral result. Subsequently the neonates were referred to diagnostic audiology.
Result: Among the 453 newborns (231 males and 222 female), AABR screening showed referral, in 43.7% of neonates. At first screening, 224 (49.4%) were referred while 229 (50.6%) passed, however, during the post-natal period 40/229 (17.5%) reported for second screening, out of these 26 showed pass to the screening. This gave a total pass of 255/453 (56.3%).
The presence of maternal pre-ecclampsia ($P=0.05$) was found to be a significant morbidity factor associated with referral in the screening, while parental socioepidemiological variables; and the neonates' birthweight, gestational age and APGAR score were not.
Conclusion: The proportion of referral on hearing screening encountered was far higher than previously reported, however, continuation of infant screening in future should be comprehensive with viral and genetic analysis in order to address the issue of aetiologic diagnosis; in addition, the implementation should factor the high drop out from the first stage screening in order to substantiate the findings in our region.

1. Introduction

The main benefit accruing from the rapid development in Neonatal Hearing Screening (NHS) program is early detection and optimal intervention of most permanent congenital and early-onset hearing impairment (PCEHI) [1,2]. Hearing plays a key part in learning to talk; without which personal development and interpersonal relationships become difficult [3]. As late as 1950, the standard policy was to wait until a hearing-impaired child had learned to speak proficiently before prescribing an individually designed hearing aid, as early detection of impaired hearing then seemed superfluous [3]. However, today, it is axiomatic that hearing impairment should be detected and treatment initiated as early as possible. Universal newborn hearing screening (UNHS) is either recommended or already practiced and legally regulated in many European nations and America [4–7]. In contrast, such a screening program is still at the pilot stage as regards its nationwide implementation in developing countries where hearing care services, such as the provision of hearing aids, only

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cover approximately 1% of all the population. In Nigeria, Olusanya [8] has documented findings from a NHS programme in Lagos, an urban city, where they documented that 285 out of 2003 eligible infants were referred after the first-stage screening and out of which 51.9% did not return for the second-stage, while 39.0% of the 82 infants scheduled for diagnostic evaluation did not present themselves. WHO has recommended the implementation of NHS program in member states, particularly in developing countries, based on the experiences and contributions of leading experts from various world regions and across relevant disciplines.

The Joint Committee on Infant Hearing [9,10] suggests that 2 physiologic measures, transient evoked otoacoustic emissions (TEOAEs) and the automated auditory brainstem response (AABR), are appropriate tools for newborn hearing screenings. These screening methodologies are completely risk-free and extremely accurate [8,9].

The most important international guidelines suggest the execution of a universal screening program should be done on all neonates and not only on those presenting increased risk factors [9,10] as only about half of the babies suffering from permanent hearing conditions present increased risk factors [11–13].

This is a pilot study of hearing screening among neonates in a rural setting with predominantly low socioeconomic people representative of the populace in Nigeria. The study used 2 health facilities in Ibadan, the first facility is a Muslim Mission Hospital where the clients are exclusively low socioeconomic class and a tertiary center where the clients are mixed but predominantly low socioeconomic class. The aim of the study is to find the proportion of neonates with referral on screening, using the automated auditory brainstem response, assess return for second stage screening and find the clinical and epidemiological risk factors which may be of significant correlation.

2. Method

2.1. Location and duration

This prospective cross-sectional study involved all newborns delivered at the University College Hospital Ibadan and the Bilal Missionary Maternity, Agodi, Ibadan. Bilal Missionary Maternity is a small maternity service located in Agodi community consisting predominantly of low socioeconomic class people, the delivery rate was estimated at about 70–80 per month while the University College Hospital Ibadan is a tertiary hospital located in Ibadan, sub-urban city in the South West of Nigeria. The study took place between October 2009 and April 2010.

2.2. Participants

All the neonates delivered during the study period were included in the screening. The screening was performed within 72 h of delivery. The parents of the children undergoing neonatal hearing screening were informed about the objectives and importance of the study. Consenting parents gave oral agreement to be included in the study. The screening was done by the first author and one of his trainees (the fourth author) who were trained in the screening procedure.

2.3. Screening procedure

The screening procedure included the automated auditory brainstem responses (AABR). The instrument was used within the manufacturers' first calibration period throughout the duration of the study and was fully automated to display the test outcome as "pass" or "refer". The test was done with the infant sleeping naturally, usually after a meal. The child was comfortably resting on his or her mother's lap. The skin was cleaned with alcohol and an abrasive paste before applying the conducting gel. Surface electrodes were the active and ground electrodes placed on the forehead and the reference electrodes was placed on the mastoids. One ear was tested at a time. Impedance between electrodes was as recommended by the manufacturer. During the test, the indication line for pass criteria was for the indicator in the diagram to continue to move upward on the graph until the green area is reached, then the pass criteria is fulfilled and the test was passed successfully. If the pass criterion is not reached after 180 s of test time, the result "refer" is displayed. The repeat AABR test was done for those who had referral in the Otorhinolaryngologic Outpatient Clinic by the fourth author as already outlined above.

The mother/family characteristics were collected prospectively at time of birth. The study received approval from the Joint University of Ibadan/University College Hospital, Ibadan Ethics Committee (UI/EC/09/0063).

2.4. Statistics

Descriptive statistics such as means, standard deviations, medians and ranges were used to summarize quantitative variables while categorical variables were summarized by percentages. The chi-squared test was used to compare proportions and also to investigate associations between two categorical variables such as automated auditory brainstem response (pass/fail) and selected variables: educational and economic characteristics of the mother classified as 1–5 according to Oyedeji [14], Apgar score (categorized into 0–3, 4–7 and ≥8), gestational age (<37 weeks and ≥37 weeks), birth weight (<2.5 kg and ≥2.5 kg), and specific morbidities. Fisher's exact test was reported for 2 by 2 tables with small cell values. All analysis was carried out using SPSS at the 5% level of significance.

3. Result

The study included 453 neonates screened for hearing impairment. There were 231 (51%) males and 222 (49%) females,

Table 1
Association between the sociodemographic characteristics of the parents and the outcome of automated auditory brainstem response.

Variables	Referral *N* (%)	Pass *N* (%)	Total *N* (%)	*P* value
Education of father				
No formal education	86(44.3)	108(55.7)	194(100.0)	0.42
Primary school	74(54.4)	62(45.6)	136(100.0)	
Grade II teacher	37(49.3)	38(50.7)	75(100.0)	
School certificate holder	20(55.6)	16(44.4)	36(100.0)	
University graduates	2(50.0)	2(50.0)	4(100.0)	
Education of mother				
No formal education	75(50.3)	74(49.7)	149(100.0)	0.37
Primary school	87(45.8)	103(54.2)	190(100.0)	
Grade II teacher	36(56.3)	28(43.8)	64(100.0)	
School certificate holder	16(44.4)	20(55.6)	36(100.0)	
University graduates	7(70.0)	3(30.0)	10(100.0)	
Occupation of father				
Unemployed	53(53.0)	47(47.0)	100(100.0)	0.52
Petty trader, messenger	64(46.4)	74(53.6)	138(100.0)	
Non manual skilled workers	90(48.1)	97(51.9)	187(100.0)	
Non academic professionals	6(75.0)	2(25.0)	8(100.0)	
Professional/senior workers	6(50.0)	6(50.0)	12(100.0)	
Occupation of mother				
Unemployed	31(51.7)	29(48.3)	60(100.0)	0.45
Petty trader, messenger	54(55.1)	44(44.9)	98(100.0)	
Non manual skilled workers	69(40.6)	101(59.4)	170(100.0)	
Non academic professionals	17(65.4)	9(34.6)	26(100.0)	
Professional/senior workers	51(52.6)	46(47.4)	97(100.0)	