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OF

## SPEECH/LANGUAGE-HEARING DISORDER AND REHABILITATION

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## JOURNAL OF SPEECH /LANGUAGE- HEARING DISORDERS AND REHABILITATION

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## EDITORIAL COMMENT

The Maiden Edition of the Nigeria Journal of Speech/Language-Hearing Disorders and Rehabilitation is being published at a time when the need to focus attention on the challenges of people with hearing and speech disorders is increasingly being felt. This is why this maiden edition of the journal features papers which directly address issues related to meeting the needs of the people with such challenges. This edition contains well researched papers such as 'Cerumen impaction and evaluation of patients with conductive hearing loss in Akure, Ondo state, Nigeria; Development of auditory gains and cognitive ability in children with central auditory processing disorder using combined compensatory strategies and assistive listening devices; Modifying learning and assessment techniques to accommodate students with hearing impairment; Early intervention- a panacea to begging for alms among persons with speech and language impairment in Nigeria; Do you call these speech errors or language disorders?; Assistive listening device: Implication for

intervention and continued auditory gains; Developmental and social impacts of speech and hearing disorders in Africa; Variations in aphasic language behaviours ( a case study of some selected bilinguals at the university college hospital (UCH), Ibadan; Patterns of hearing loss associated with bomb blasts; challenges of oesophageal voice rehabilitation post laryngectomy in otorhinolaryngology clinic of a tertiary health institution; to survey of speech disorders among school children in selected Nigerian states; -all address issues that are central to helping people with speech defects and hearing loss. It is our hope that readers will find in the papers information and facts that will help them to have a better appreciation of the challenges and needs of people with speech impairments and hearing loss/disorders and subsequently put in measures that will help to alleviate their speech and hearing problems.

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## PATTERNS OF HEARING LOSS ASSOCIATED WITH BOMB BLASTS

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### Abstract

*Bomb blast injuries are becoming an everyday scenario in Nigeria due to ever increasing act of terrorism. Such injuries in addition to affecting the functional living of the individual, is also accompanied with different patterns, nature, severity and types of hearing loss. The auditory mechanisms are usually affected as many victims of bomb blasts never get to use the hearing mechanism for adequate functional and communicative purposes. Against this background, a descriptive research design was conducted to investigate the patterns of hearing loss associated with bomb blasts. 45 victims of bomb blasts were assessed with the use of otoscopy, pure-tone audiometry (PTA) and tympanometry to ascertain their hearing thresholds and extent of hearing disability. The results showed that different patterns of abnormal audiogrammes and tympanogrammes of bomb blast ear injuries were evident among the participants, as there were more adverse effects of the explosion than could be imagined. Therefore, to every bomb blast, victims should consult audiologists for appropriate audiological rehabilitation and follow-up services; as hearing impairment from bomb explosions may have a lasting impact.*

**Keywords:** Audiogrammes, bomb blasts, ear injuries, hearing loss, tympanogrammes, thresholds

Exposure to impulse sounds such as noise from gunshot, bomb blast and steady-state generated sounds via turbine have been observed to have some deleterious effects on the overall human hearing. This kind of sound exposure is potentially hazardous to hearing and psychological well-being of people in the sense that such generated sounds which could be referred to as "noise", are appreciably louder than any conversational level, and remain potentially harmful to the delicate sensory structure of the auditory portion of the inner ear (cochlea). Exposure to this short duration sound of sufficient intensity may result in an immediate or severe and permanent hearing loss, termed acoustic trauma. Consequently, it has been observed that moderate exposure may initially cause temporary hearing loss or temporary threshold shift (TTS), although structural changes may be associated with this shift as there will be evidence of a regional decrease in the stiffness of the stereocilia (the hair bundles at the top of the haircells) leading to a decrease in the coupling of sound energy to

the haircells which thereby alters hearing sensitivity (Lusk 1997; Araujo, 2002). In addition, it causes other problems such as hearing deficits due to threshold and suprathreshold deficits, heating of the human skin, a kind of sensation or vibration in the bones of the cranium and movement of air in the sinuses and nasal passage, blurring of the visual organ and difficulty in maintaining balance and coordination (Lusk, 1997; Spon & Spon, 1991). Based on the aforementioned, exposure to bomb blast could result to ear injuries and eventual hearing loss. Bombing exposure may be responsible for at least some cases of Sensori-Neural Hearing Loss (SNHL), as the explosive sound can damage all parts of the ear, tearing membrane apart, moving bones around, and leading to either temporary or permanent hearing loss (Berke, 2009).

Bomb blast ear injuries are becoming common phenomenon due to ever increasing acts of terrorism and harassment in Nigeria. Notably, ear injuries and attendant



effect(s) on the overall hearing sensitivity of the afflicted individuals have been observed in recent times. Explosion of bombs across the country has caused a lot of ear injuries to people. These include perforation of the tympanic membrane, disruption of the ossicles which may lead to dislocation of the incudo-stapedial joint, severe auditory and vestibular disturbance; spontaneous discharge or bleeding from the ears; acute ear pain; lateralisation and detachment of the sensory cells from the basilar membrane, and evidence of cholesteatoma (James, Pickett, Burdett & Cheesman, 1982; Strohm, 1986).

Bombing exposure has been observed to be responsible for at least some cases of SNHL in babies born to mothers who had lived through war. According to Berke (2009), during the war between Iran and Iraq, more children were born with unexplained hearing issues as their mothers were exposed to bomb-related noise. To this end, it has been opined that bombing is capable of causing blast-ear injury, deafness and acoustic trauma. Such explosive sound can damage all parts of the human ear, leading to either temporary or permanent hearing loss.

In Nigeria today, act of terrorism and attendant effects of bomb blasts are on the increase, thereby making people in the neighbourhood of the scene or site become vulnerable to sudden hearing loss and spontaneous loss of lives. In fact, cases of ear injuries have been noticed to have some impacts on the people, which range from primary through tertiary. The primary effect due to loud explosives may bring about pulmonary barotraumas, abdominal hemorrhage, rupture and perforation of the tympanic membrane, fracture and dislocation of ossicles, cochlear damage, vertigo and tinnitus, dizziness and ear pain. At secondary level, blunt injuries may be experienced, while tertiary effect may be in line with fracture and traumatic conditions as well as brain injury and psycho-social adjustment difficulties. In fact, exposure to any kind of bomb blast may result in severe auditory and vestibular disturbance, while the flying debris consequent upon it may cause secondary injuries and amputation of the ear-lobe (Patow, Bartels & Dodd, 1994), and induce the detachment of the sensory cells from the basilar membrane as they may propel sudden hearing loss. In line with this observation, this study aims to evaluate the extent of bomb blast ear injuries in order to determine the effect of bombing on ears towards designing appropriate management protocols in attending to the needs and rights of individuals who may be affected by the bomb blast.

### Purpose of the Study

This study was conducted basically to:

1. evaluate the extent of bomb blast ear injuries via otoscopic, audiometric and tympanometric examinations;

2. determine the configurations and types of hearing loss based on the audiograms obtained from patients with experience of bomb blast;
3. determine the prevalence of bomb blast ear injuries and cases due to act of terrorism; and
4. design an appropriate management and rehabilitation as well as procedural services and steps to ameliorate the pain and damage associated with bomb blast ear injuries.

### Research Questions

1. What are the type of audiogrammes and tympanogrammes associated with bomb blast ear injury?
2. What is the nature of perforation in the ear-drum as result of bomb blast ear injury?
3. What are the types of hearing loss common among the participants?

### Methodology

This study adopted the retrospective research design, sampling 45 bomb blast patients purposively selected among other patients routinely referred to Ear, Nose, and Throat Clinic, National Hospital, Abuja. The patients were presented consequent upon episodes of bomb blast. The following information were extracted from their case-files: age, sex, occupation, open or confined place of bomb blast, and subjective effects of bomb blast taken by the GP during the period of clerking. Thereafter, physical evaluation, otoscopic evaluation, and basic hearing assessments such as Pure Tone Audiometry (PTA), Tympanometry and Speech Audiometry were conducted on the participants. An audiometer which has been well calibrated to British Standards, International Standards Organisation, American National Standards Institute specification and biologically evaluated for efficiency and reliable outcomes was employed to perform PTA and speech audiometry on the patients, while Tympanometer was the test instrument used to evaluate the middle ear ability/inability of the participants.

These instruments were used to assess the 90 ears comprising 52 ears of the male gender and 38 ears of the female gender of the participants. These ears were audiometrically evaluated within four hours of the bomb explosion. The study participants were between ages 12 and 55 years. The data gathered were analysed using descriptive statistics of frequency count and percentage.

### Results

**Question 1: What are the types of audiogrammes and tympanogrammes associated with bomb blast ear injury?**

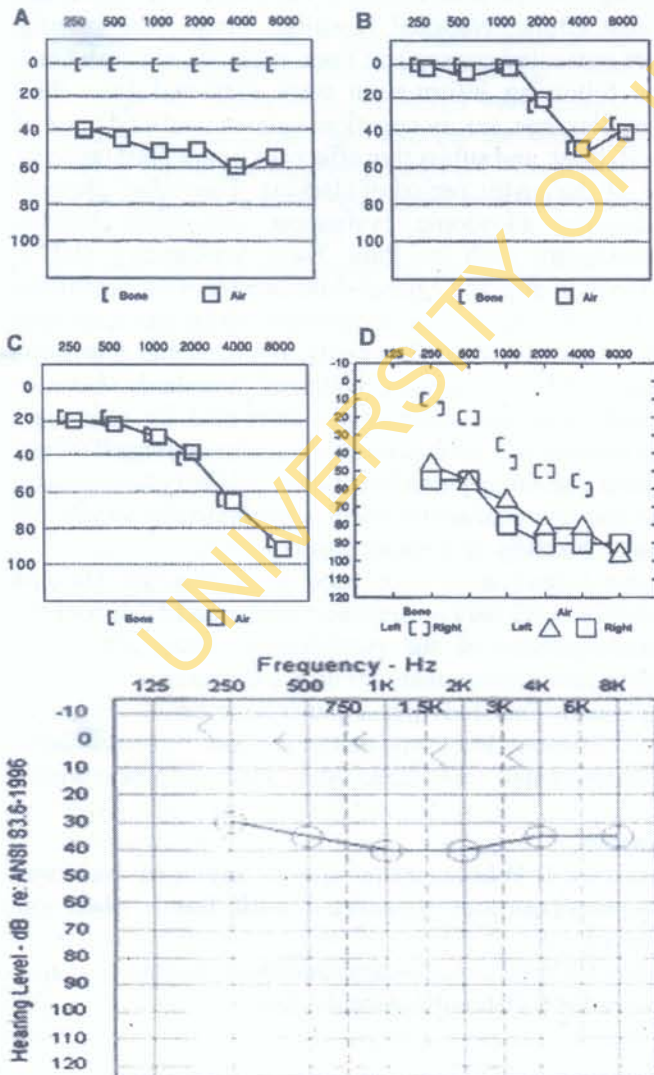
**Table 1:** Observed audiogrammes and tympanogrammes associated with bomb blast ear injury



| Types          | Configurations |            |            |            |                                   |             |
|----------------|----------------|------------|------------|------------|-----------------------------------|-------------|
|                | Downward slope | Carhart    | Flat       | Dip Notch  | Atypical 4kHz DIP (Noise Induced) | Total       |
| Audiogrammes   | 13 (14.4%)     | 16 (17.8%) | 15 (16.7%) | 19 (21.1%) | 27 (30.0%)                        | 90 (100.0%) |
| Tympanogrammes | A              | AD         | AS         | B          | C                                 | Total       |
|                | 4 (4.4%)       | 62 (68.9%) | 2 (2.2%)   | 6 (6.7%)   | 16 (17.8%)                        | 90 (100.0%) |

Table 1 shows the observed types of audiogrammes and tympanogrammes associated with bomb blast ear injury. A large percentage of the audiogrammes reveals a typical 4kHz dip, which suggests evidence of noise-induced hearing loss (NIHL). On the other hand, 62 (68.9%) of the 90 ears evaluated show evidence of abnormal ear pressure and increased compliance, while only 4 (4.4%) of the ears show normal compliance to the standard norm.

Figure 1: Audiogrammic Representations of the Participants

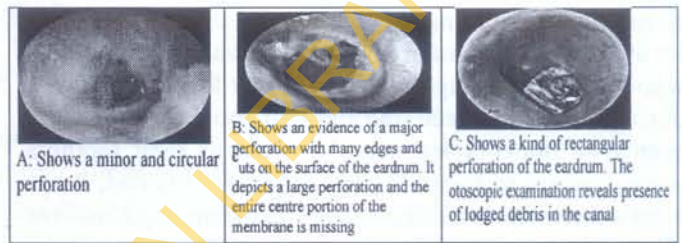


The illustrated Figures A- E (Figure 1) above shows typical examples of audiogrammic representations of the auditory performance of the participants, due to bomb blast exposure.

**Research Question 2: What is the nature of perforation in the eardrum as a result of bomb blast ear injury?**

Below are the three (3) common types of Ear drum perforation found in the examined ears of the participants due to bomb blast Ear injury.

Figure 2: Photographs of the Examined Tympanic Membrane



**Research Question 3: What are the types of hearing loss common among the participants?**

Table 2: Types of Hearing Loss of Participants

| Types          | Frequency | Percentage (%) |
|----------------|-----------|----------------|
| Normal         | 04        | 4.5            |
| Conductive     | 22        | 24.4           |
| Mixed          | 28        | 31.1           |
| Sensori-neural | 36        | 40             |
| <b>Total</b>   | <b>90</b> | <b>100</b>     |

Table 3: Observed Hearing Conditions

| Conditions           | Frequency | Percentage (%) |
|----------------------|-----------|----------------|
| Foreign Bodies       | 09        | 10             |
| Tympanic Perforation | 32        | 35.5           |
| Tympanic rupture     | 11        | 12.2           |
| Otalgia              | 23        | 25.6           |
| Tinnitus             | 38        | 42.2           |
| Vertigo              | 19        | 21.1           |
| NIHL                 | 27        | 30.0           |
| Otorrhea             | 7         | 7.8            |
| Decreased Hearing    | 41        | 45.6           |

Tables 2 and 3 show the various types of hearing loss and conditions observed among the participants due to bomb blast ear injury. Also, it was observed that SNHL (40%) is the most common type of hearing loss, as against 31.1%



and 24.4% of mixed and conductive hearing losses, respectively. Majority of the participants presented evidence of tinnitus (42.2%), noise-induced hearing loss (NIHL) (30.0%), decreased hearing condition (45.6%), and otalgia (25.6%). Some 35.5% of the participants had their eardrum perforated, while only 10% had their ear canal lodged with foreign bodies.

### Discussion

With the findings of this study, it has been established that decreased hearing loss, otalgia, tinnitus, NIHL, and SNHL are very common with ear injury consequent upon bomb-blast exposure. In fact, 40% of the participants presented with SNHL. This was in line with the observation of Berke (2009) that bombing exposure may be responsible for at least some cases of SNHL.

A typical 4 KHL dip notch-pattern with indications of NIHL was found prevalent among the participants. This finding corroborates Chen and Tsai (2003), Gelfand (2001), and Kryoo (2010) that exposure to high level of noise would affect the pattern of hearing threshold of those in such environment, and that NIHL would occur at higher frequencies (3, 4 or 6KHL), and later spread to the low frequencies (0.5, 1 or 2KHL). Similarly, majority of the participants had SNHL (40%), and mixed hearing loss (31.1%), as noise-bombing which could be regarded as explosive sound poses a serious risk and deleterious effect on the unwilling ears (Jaiswal & Jaiswal, 2003). The results of this study show that different patterns of abnormal audiogrammes and tympanogrammes of bomb blast ear injuries were evident among the participants, as there were more adverse effects of the explosion than anticipated. This study has also established that exposure to noise-bombing would bring about sudden hearing loss, in the sense that many survivors of bomb blasts incurred hearing loss, especially blast injury deafness, which led to either temporary or permanent hearing loss (Berke, 2009).

### Conclusion

Exposure to any sound above 85dB is considered as a sound with a potential capacity to damage and destroy the normal pattern of hearing threshold of anyone who exposes his/her hearing organ to such, even once. Based on this study, it is noted that such exposure will lead to sudden hearing loss, disruption of hearing pattern, and rupture or even perforation of the tympanic membrane. Therefore, exposure to high level of noise, noise pollution and noise-bombing must be curtailed or done with necessary precautions and safety, while noise-bombing should be banned because of the aforementioned attendant effects of such exposures. Also, based on the findings of this study, it could be deduced that the prevalence of bomb blast-induced hearing injury in Nigeria is high.

### Recommendations

1. Noise-bombing or bombing raids should be

discouraged or banned in our society, as the effects of such raids may lead to irreversible hearing loss and other attendant problems. Therefore, peaceful approach to conflicts should be resolved.

2. Contours, bomb blasts and exposure to noise-bombing would increase the prevalence of hearing loss and other associated problems. Therefore, these situations should be avoided as much as possible.
3. All people around the bomb blast sites should undertake audiometry test, to detect any symptom of hearing loss on time
4. Victims of bomb blasts should not assume that their hearing is intact, but rather consult audiologists for appropriate audiological assessment, as well as rehabilitation and follow-up services if need be.

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