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Research Article

Vestibular Changes among Noise- Exposure Workers

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Abstract

Objective: Is to assess the vestibular system among chronic noise exposure workers.

Design: A prescriptive study.

Setting: Otolaryngology unit in Jazan General Hospital - Saudi Arabia Kingdom.

Patients: The study include 90 adults males divided into two groups: Noise exposure group (N group) that contain 45 workers with occupational noise exposure for more than 10 years and the control group(C group from normal voluntaries from non-noise exposure employee).

Methods: All participants in both groups were subjected to vestibular assessment using Video nystagmograph.

Results: Pure tone audiometry showed a significant reduction in N group high frequencies threshold compared with C group. Vertigo attacks were reported in 11 workers (24.4%) among the N group and VNG revealed 6 workers (13.3%) from N group diagnosed as peripheral insult while Benign paroxysmal positional vertigo (BPPV) found in 3 workers (6.7%) finally 36workers (80%) in the same N group had normal "VNG" findings.

Conclusion: Vestibular dysfunction could be occurred in chronic noise exposures workers.

Keywords: Noise; Hearing Loss; Vertigo; VNG

Introduction

Noise is one of the biological stressors associated with everyday life which has physical, physiological and psychological connotations with hearing loss that considered a common cause of acquired sensorineural hearing loss [1]. Many occupational workers have noise induced hearing loss complaining from balance symptoms as dizziness and vertigo [2]. Unsteadiness, vertigo and lightheadedness are terms that can appear in the patient's description of symptoms [3]. Many authors mentioned for vestibular changes occurred with cochlear damage as both receptors share the same blood supply that can explain the association between vestibular disorders after prolonged noise exposure [4]. The greatest challenges for dizziness evaluation are determining the patient's complaints as a result of a disorder for vestibular system which responsible for motion control [5]. The semicircular canals provide afferent input to vesitbulo-ocular reflex (VOR) aiming for stabilizing the visual image on the retina during rotation [6]. Nystagmography still remains the most widely used test for evaluation patients balance disturbance that provide beneficial diagnostic information [7]. Video nystagmography (VNG) which is an infrared computerized video technique utilized for recording eye movements in three dimensions classified as non-invasive, requires little setup time without requiring repeated calibrations [8]. The aim of our study designed to identify the video nystagmography changes among noise-exposure industries workers.

Subjects & Methods

A prospective study was carried out in otolaryngology outpatient clinic and the balance disorders monitoring unit in Jazan General Hospital - Saudi Arabia Kingdom from 2014 to 2017.

The study include 90 adults (age ranged from 26 to 60 years) were divided into two groups: Noise exposure group (N group) that contain 45 workers with occupational noise exposure for more than 10 years (eight hours a day, six days a week) and the control group (C group from normal voluntaries from non-noise exposure employee) consisted of 45 employees who also had eight hours a day, six days a week without exposed to hazardous noise at any point of their work. Exclusion criteria include cervical or intracranial lesion or history of ototoxic drugs, a history of ear infections, head trauma, neurological deficit or history of acoustic trauma.

All participants in both groups were subjected for personal data, vertigo symptoms, Otological examination, Basic audiometry "ORBITER 922 Version 2 Clinical Audiometer" "Madsen Electronics, Denmark" in a double-walled treated room (Pure tone& speech) and finally Video nystagmograph "ICS medical VNG computerized analyzer, USA" (which include Spontaneous nystagmus test, Gaze-evoked nystagmus test, Head positional test, Saccade test Sinusoidal tracking (ocular smooth pursuit) test, Optokinetic test, Dix-Hallpike test (Dix and Hallpike, 1952 and Bithermal caloric test [9].

Statistical analysis

Data collected were processed using SPSS version 21 (SPSS Inc., Chicago, IL, USA). Quantitative data expressed as means ± SD while qualitative data expressed as numbers and percentages. The student t testis used to compare the significance of difference for quantitative

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variables that follow normal distribution.

Ethical considerations

Written informed consent was taken from the participants and the participants did not have any objection to participate in the research study. The local ethics committee approved the study.

Results

90 adult patients with mean age 39.4 ± 6.4 years were divided into two groups according to noise exposure for at least 10 years; noise exposure group (N group) that contain 45 workers and the control group (C group from normal voluntaries from non-noise exposure employee in the same industries).

The most frequent complaints among N group participants were tinnitus in 23 (51.1%), decrease in hearing acuity in 14 (31.1%), decrease in speech discrimination perception in 13 (28.8%) and vertigo attacks in 11 (24.4%) who had vestibular symptoms, reported that vertigo came in attacks occurred five or seven times a week and it lasted for 5 minutes with increased heart rate increased by the end of day work and relatively relieved during non-working days. There were no complaints among C group regarding to the questionnaire evaluation. All participants in both groups reveled normal tympanometric study for the middle ears regarding type a tympanometry pure tone audiometry showed a significant reduction in N group high frequencies threshold compared with C group that were 15dB compared with 14dB at 250Hz, 16dB and 15dB respectively at 500Hz, 18dB compared with 17dB at 1KHz without any statically significant difference in both groups in previous frequencies but at 2KHz were 29dB and 18dB respectively, at 4KHz 41dB and 25dB respectively while at 8KHz were 49dB and 25dB respectively with a significant reduction in N group high frequencies threshold compared with C group as seen in (Table 1).

Spondee reception threshold (SRT) and speech discrimination score (SDS) shows no significant difference between N group and C group.

All participants in both groups were subjected to VNG study with normal results for all C group employees while 6 (13.3%) participants from N group found to be peripheral insult while BPPV found in 3 (6.7%) and 36 (80%) with normal "VNG" findings. No central or mixed lesion could be detected.

Discussion

Auditory dysfunctions constitute frequent complaints in the population studied, thereby reinforcing the need for permanently adopting both collective and individual preventive measures relating to noise exposure as many research and assessment of auditory dysfunction are fundamental in the occupational examinations of workers exposed to noise when noise induced hearing loss has been established in the presence of an auditory dysfunction, such as tinnitus, it can be an important factor for causing suffering and negatively affecting the quality of life of workers [10].

The balance function is controlled by cerebellum and the cortical structures apart from vestibular structures. In instances of vestibular end organ damage, the compensatory strategies may be adopted by the central nervous system. Therefore, there is a real need to thoroughly examine the signs and symptoms presented by factory workers while taking history and clinical examination [11].

Table 1: Shows the mean intensity threshold among N group and C group in different frequencies.

Frequency	N group		C group		P
	X	SD	X	SD	
250 KHz	15	3.639	14	2.813	>0.05
500 KHz	16	2.963	15	3.908	>0.05
1 KHz	18	6.109	17	5.093	>0.05
2 KHz	29	5.093	18	4.438	*<0.05
4 KHz	41	5.917	25	4.398	*<0.05
8 KHz	39	6.073	25	5.915	*<0.05

X=mean
SD=standard deviation
P value <0.05=significant (*)

As the exposure to noise increased, there was an increase in severity of dizziness. This is another supporting factor indicating that noise is the cause of dizziness in these workers. Another factor supporting the hypothesis is that in most instances reduced hearing sensitivity and tinnitus are positively correlated. Coexistence of vestibular and otological symptoms strongly indicates that the vestibular and cochlear structures are gradually degenerating together due to chronic exposure to noise [12].

Vestibular symptoms exhibited by factory workers can be owed to the constant onslaught of noise on the ears of these workers; the symptoms exhibited by these workers are subtle due to which vestibular symptoms are neglected; and these symptoms do not affect their functional ability. Therefore, it is recommended that every person who reports history of exposure to occupational noise, is asked to complete a questionnaire such as the one used in the present study and investigated for vestibular symptoms [11].

The incidence of subjective cases reflects the occurrence of functional symptoms with no underlying pathophysiological changes, psychogenic factors in such cases should not be ignored as it may play an important role. This discrepancy between the subjective and objective vestibular findings indicates the presence of a psychological factor that may cause persistence of the balance disorders symptoms [13].

The cases that developed benign paroxysmal positional vertigo BPPV are exposed to noise trauma and none of them are exposed to head trauma.

The unsteadiness and dizziness has a higher incidence in the subjective cases supporting the absence of a true vestibular lesion. It is clear that the vertigo was mainly in the moderate and severe cases while the unsteadiness and dizziness were only in the minor and mild cases.

All the cases with balance disorders are treated by medical treatment or by rehabilitation programs or both.

Wu and Young (2009) note the abnormal VEMP responses noted above may have been related to saccular damage secondary to gunshot/noise exposure and they note the combined earplugs and earmuffs may not be sufficient to protect the saccule from long term noise exposure [14].

Loud tones can damage the cochlea, but vestibular involvement has been given less attention. However, patients with noise induced hearing loss (NIHL) sometimes have balance disorders as well as some have symptoms resembling those of Meniere's disease episodic vertigo in NIHL patients may result from a pathophysiological mechanism similar to that of Meniere's disease [15].

Conclusion

Vestibular dysfunction could be occurred in chronic noise exposures workers.

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