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Prevalence of auditory and vestibular symptoms among workers exposed to occupational noise

ABSTRACT

The purpose of the study was to assess the prevalence of auditory and vestibular symptoms in workers exposed to occupational noise. There were examined medical records of 175 workers with noise-induced hearing loss who attended an occupational health reference center in the city Campinas, Southeastern Brazil, from 1997 to 2003. The variables studied were frequency of symptoms of hypoacusis, tinnitus, and vertigo. Association with age, noise exposure time, and auditory thresholds were analyzed using the chi-square test and Fisher's exact test. Hypoacusis was reported in 74% of cases, tinnitus in 81%, and vertigo in 13.2%. There was found an association between hypoacusis and age, noise exposure time, and auditory thresholds and between vertigo and noise exposure time. No other significant associations were found.

DESCRIPTORS: Noise, Occupational, adverse effects. Hearing Loss, Noise-Induced. Occupational Risks. Occupational Health. Epidemiology, Descriptive.

INTRODUCTION

Work-related noise-induced hearing loss (NIHL) is a gradual reduction in auditory acuity, arising from continuous exposure to high levels of sound pressure.[5] While NIHL can be prevented and its consequences may result in different types of damage. It may lead to auditory disability, auditory dysfunctions – such as tinnitus and vestibular disturbances – and even make it difficult to join the job market. In Brazil, despite the evolution in knowledge about NIHL, cases of workers suffering lesions still occur.

According to Neuberger et al[4] (1992), tinnitus is the first warning of exposure to excessive sound stimulus, and may indicate greater susceptibility to lesions caused by noise. This is an important symptom in the prevention of NIHL and one of the main predictive factors of disadvantages suffered by workers who are exposed to noise.

The objective of this study was to estimate the prevalence of auditory and vestibular symptoms in workers exposed to occupational noise.

METHODS

A cross-sectional study with workers who had health complaints related to work was conducted in the city of Campinas, Southeastern Brazil, and region. Between Januray 1997 and August 2003, 190 workers were sent by trades unions, by the public health network or by spontaneous demand to be examined at an occupational health medical reference center.

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Workers with auditory complaints were evaluated during occupational-medical and audiological consultations, in accordance with the requirements of the National Noise and Hearing Conservation Committee. Their patient records, containing details of their audiological, clinical and occupational anamneses and audiometric examinations were analyzed.

For the audiometric assessment the criteria of this same Committee were followed.[5] Of the 190 cases selected 175, were diagnosed to be suffering from NIHL. According to the classification of the NR7 Regulatory Norms,[a] only those cases in which noise was the main cause of hearing loss were maintained.

The variables studied in audiological anamnesis were: gender; age; area of activity of the company; total exposure time to noise; complaining of hypoacusis ("How do you think your hearing is?": normal; bilaterally or unilaterally reduced); complaining of tinnitus ("Do you have a buzzing in the ears?"); ear affected and frequency of the buzzing (constantly or intermittently) and complaining of vertigo ("Do you suffer from dizziness?). The outcome variables were symptoms of vertigo, tinnitus and hypoacusis. From the audiometry the right and left ears were assessed separately: M1 (average of 500, 1,000 and 2.000 Hz) and M2 (average of 3,000, 4,000 and 6,000 Hz). The frequency of complaints of hypoacusis, tinnitus and vertigo were analyzed and their association with age, time of exposure to noise and tonal auditory thresholds was noted.

To describe the profile of the sample descriptive statistics were carried used and to analyze the relationship between the category variables the chi-squared test and Fisher test with a significance level of 5% ($p<0,05$) were used.

The SAS program, version 8.02 was used to carry out the statistical analysis.

The study was approved by the Research Ethics Committee of the *Faculdade de Ciências Médicas* of *Universidade Estadual de Campinas*.

RESULTS

In the patient records analyzed, some workers had been exposed to noise for years without carrying out audiometry. Some had had an audiological assessment for the first time at the health reference center studied.

The sample comprised 174 men and one woman, who were between 21 and 63 years old. The average total time of service during which they were exposed to noise was 15.75 years (SD= 7.48), with a minimum of one and maximum of 36 years service. The 20-29 age group represented 3% of the population; 28% were in the 30-39 group; 48.6% in the 40-49 group and 20.4% were over 50.

The main branch of activity was the metal-working industry, with 74.1%, followed by the transport sector with 9.2%. The other 16.7% were represented by civil construction, the textile sector, mining and others.

With regard to the noise exposure time variable, 22.9% had been exposed for less than ten years; 45.5% between ten and 19 years; 26.4% between 20 and 29 years and 5.2% had had more than 30 years of exposure.

The following frequency distribution of complaints was observed: hypoacusis in 74% of the cases, bilateral impairment in 70.4%; tinnitus in 80.8%, of which in 54.1% it was constant and in 54.7% bilateral, and vertigo in 13.2%.

There was an association between hypoacusis and age; between hypoacusis and time of service and between hypoacusis and tonal thresholds. In M1 in the right ear, there was an association tendency with hypoacusis and an association in the left ear. In M2 there was an association, bilaterally. An association was also observed between vertigo and exposure time to noise. (Table)

There was no association between tinnitus and age; tinnitus and noise exposure time; tinnitus and tonal thresholds; vertigo and age, or age and tonal thresholds.

DISCUSSION

The results indicate high prevalence of symptoms of hypoacusis, tinnitus and vertigo in the population studied.

A limitation of this work is its use of secondary data. So it was not possible to obtain information about the different levels of exposure to noise and other risk factors that can aggravate the effects of noise, such as solvents. Neither was it possible to compare the information reported in the occupational history with their records. Furthermore, the peculiarities of Brazilian workers and the population attended by the health reference center studied must be taken into consideration. Most of the people go to the center spontaneously, or are sent there by a trade union,[b] often after having being dismissed, in an attempt to receive some benefit from the National Social Security Institute or via an action for damages.

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[a] Ministério do Trabalho. Portaria No. 24, de 29 de dezembro de 1994. Altera a redação da NR-7 - Programa de controle médico de saúde ocupacional. *Diario Oficial Uniao*. 30 dez 1994.

[b] Centros de Referência em Saúde do Trabalhador. Campinas: 17 anos de construção pela saúde dos trabalhadores. In: A saúde do trabalhador e saúde ambiental: cenário, experiências e perspectivas – 2003. I Conferência Regional de Saúde do Trabalhador e Meio Ambiente de Piracicaba; 2003; Piracicaba, BR. Piracicaba: Centro de Referência em Saúde do Trabalhador; 2003. p. 125.

Table. Association between age, time of service and tonal thresholds with vertigo, hypoacusis and tinnitus in workers. City of Campinas and, Southeastern Brazil, 1997-2003.

Variable	Vertigo				Hypoacusis				Tinnitus			
	No		Yes		No		Yes		No		Yes	
	n	%	n	%	n	%	n	%	n	%	n	%
Age (years)												
<40	49	90.74	5	9.26	23	44.23	29	55.77	11	21.15	41	78.85
40-49	72	85.71	12	14.29	20	24.10	63	75.90	18	21.43	66	78.57
≥50	30	83.33	6	16.67	1	2.86	34	97.14	4	11.11	32	88.89
p		0.5503[a]				<0.0001[b]				0.3836[c]		
Time of service (years)												
<10	36	90.00	4	10.00	15	39.47	23	60.53	4		35	89.74
10/19	73	92.41	6	7.59	23	29.49	55	70.51	17	22.08	60	77.92
≥20	42	77.78	12	22.22	5	9.43	48	90.57	12	21.82	43	78.18
p		0.0382[d]				0.0028[e]				0.2653[f]		
Tonal thresholds M1 R												
M1≤25 dB	135	87.10	20	12.90	43	28.10	110	71.90	30	19.74	122	80.26
M1>25	16	84.21	3	15.79	1	5.88	16	94.12	3	15.00	17	85.00
p		0.7208[a]				0.0754[b] *(trend)*				0.7686[c]		
Tonal thresholds M1 L												
M1≤25 dB	130	86.67	20	13.33	43	29.25	104	70.75	28	18.92	120	81.08
M1>25	21	87.50	3	12.50	1	4.35	22	95.65	5	20.83	19	79.17
p		1.0000[a]				0.0112[b]				0.7844[c]		
Tonal thresholds M2 R												
M2≤25 dB	24	92.31	2	7.69	13	52.00	12	48.00	3	12.00	22	88.00
25<M2≤40	66	88.00	9	12.00	22	29.33	53	70.67	16	21.62	58	78.38
40<M2≤55	36	85.71	6	14.29	8	19.51	33	80.49	10	24.39	31	75.61
M2>55	25	80.65	6	19.35	1	3.45	28	96.55	4	12.50	28	87.50
p		0.6161[a]				0.0005[b]				0.4310[c]		
Tonal thresholds M2 L												
M2≤25 dB	20	90.91	2	9.09	9	40.91	13	59.09	7	31.82	15	68.18
25<M2≤40	59	84.29	11	15.71	24	34.78	45	65.22	9	13.04	60	86.96
40<M2≤55	45	91.84	4	8.16	9	18.75	39	81.25	10	21.28	37	78.72
M2>55	27	81.82	6	18.18	2	6.45	29	93.55	7		27	79.41
p		0.4964[a]				0.0051[b]				0.2489[c]		

M1 R: Average of 500,1000 and 2000Hz in the right ear
M1 L: Average of 500,1000 and 2000Hz in the left ear
M 2 R: Average of 3000, 4000 and 6000Hz in the right ear
M1 L: Average of 3000, 4000 and 6000Hz in the left ear
[a] Loss: 1
[b] Losses: 5
[c] Losses: 3
[d] Losses: 2
[e] Losses: 6
[f] Losses: 4

The results of this study proved to be compatible with the characteristics and history of the development of NIHL in the study carried out by Nudelmann et al,[5] such as: most frequent age group (over 30), more disturbances in M2 than in M1 when assessing the averages of the frequencies, complaining of predominantly bilateral hypoacusis and a correlation between complaining of hypoacusis and time of service.

In this study, the hypoacusis symptom was more frequent in older individuals and those with more service time. Even with M1, which are considered to be frequencies important for communication (≤25 dB: threshold within normality), almost 70% of the workers complained of hypoacusis. There was a strong association between hypoacusis and M2 in the sample studied.

Golz et al[3] (2001) assessed 258 males from military service in Israel who were exposed to intense impulse and impact noises and concluded that evidence of vestibular pathology can only be observed when there is asymmetric hearing loss. In symmetrical hearing loss, the symmetrical lesion of the vestibular system is probably responsible for the absence of abnormal findings in the vestibular function tests. According to Golz et al[3] (2001), there is no association between the seriousness of hearing loss and symptomatology and vestibular pathology.

The report of tinnitus (80.81%) in the population studied was much greater than the prevalence reported in the literature on NIHL. Dias et al[2] (2006) assessed 284 workers in the city of Bauru, Southeastern Brazil, and found a prevalence of NIHL of approximately 63% and tinnitus of 48%. These authors found an association between noise-induced hearing loss and tinnitus and an increase in the prevalence of buzzing as the auditory damage evolved, controlled by age and exposure time. Aragute et al[1] (2000) observed an 82.6% (57 workers) prevalence of tinnitus in workers assessed at another worker health reference center in the city of São Paulo, Southeastern Brazil, thus showing the most similar findings and sample characteristics when compared to the present study. Neuberger et al[4] (1992), when assessing 110,647 workers exposed to occupational noise in Austria, found a report of tinnitus in 7,445 workers (6.7%); in the population not exposed only 0.8% reported buzzing.

In conclusion, auditory dysfunctions constitute frequent complaints in the population studied, thereby reinforcing the need for permanently adopting both collective and individual preventive measures relating to exposure to noise. Furthermore, research and assessment of auditory dysfunction are fundamental in the occupational examinations of workers exposed to noise. Once NIHL 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.

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