



EVALUATION OF OCCUPATIONAL HEARING AND VESTIBULAR IMPAIRMENT IN CAST IRON FOUNDRY WORKERS

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ABSTRACT

There are many nocuous factors in the working environment in cast iron foundries, such as noise, vibrations and dust, over and above the threshold limit values. The occupational risk factors have a complex effect upon the health and working capacity of the workers. Subject of this investigation are 398 people working in a cast iron foundry, exposed to occupational noise and vibrations. The following tests were performed: full ORL examination, a full audiometric threshold and above threshold examination, a full otoneurological test and carniocorpography. Functional changes in the inner ear were observed as either isolated impairments of the hearing organ or a combined impairment of both the hearing and vestibular organs. Damage to the vestibular organ is more pronounced after the combined impact of occupational noise and vibrations with whole body impact. Diagnostic and work fitness assessment issues were discussed.

Key words: nocuous factors, noise, vibrations, impairment

INTRODUCTION

The combined effect of physico-mechanical factors creates extreme conditions for the functioning of the hearing and vestibular organs – a high degree of neuro-sensory tension and heightened demand for rapid adaptation and precision in the perception of the working environment and labor process.

The hearing and vestibular senses are as sensors for the general peripheral, central-brain and neuro-vegetative activity of the organism and they have not as yet been complexly studied from an occupational pathology aspect. This necessitates an in-depth investigation of the risk factors in production that systematically burden neural structures.

The specific impairments caused by noise and vibration include noise adaptation, hearing tiredness, neuritis of the hearing nerve

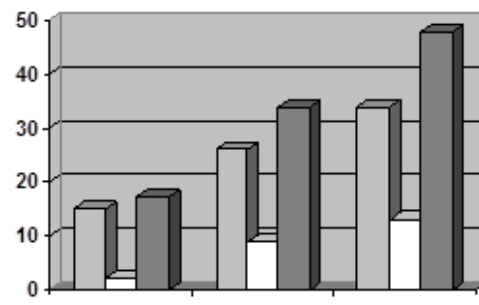
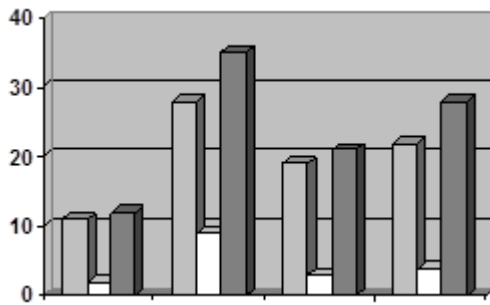
(occupational deafness) acute hearing trauma. The non-specific impairments include impairment of: the vestibular organ, the cardiovascular system, endocrinal system, the motor apparatus, etc. A correlation is also needed of the specific and non-specific biological defects and accordingly a prognosis regarding possible damage and impairment.

The present investigation has as its aim to study the functional status of the hearing and vestibular organs of workers employed in cast iron foundries exposed to above norm noise and vibration impact.

Three hundred and eighty one workers were included, filling various work positions, and distributed according to age, sex, duration of employment, harmful factors and professional occupation noxiousness parameters (group I and II).

The histograms shown are according to age and length of employment. (1&2)

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Noise Level: 94-102 dB (A), norm: 85dB
 Frequency of total vibrations: 0.20-0.40 m/sec 10-2, norm 0.20 m/sec 10-2

METHODS

-Tonal threshold audiometry (evaluation of degree, type and level of impairment of the hearing organ. Tonal above-threshold audiometry (determines the type of perception of acoustic signals with above-threshold intensity, especially deformations in sound intensity – recruitment phenomenon.

-Vestibular-spinal and cerebral tests (standardized sensibilised Romberg, index finger to nose test, Babinski-Weil walking test, Fukuda stepping test, checking for spontaneous sNy with Frenzel goggles, evaluation of vestibular-vegetative symptoms, caloric provocation (cold).

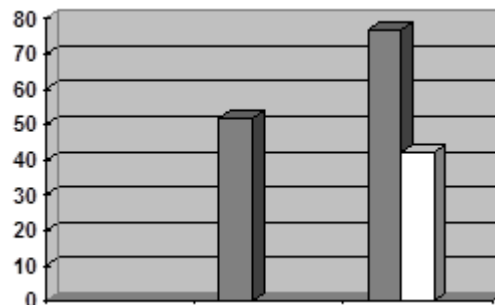
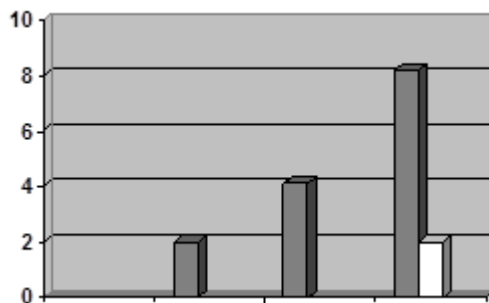
RESULTS

The clinical audiometric evaluation demonstrated not only the familiar pathognomonic audiometric results (decrease in hearing perception at 4000 Hz, etc.) but also certain trends in the development of occupational hearing neuritis.

DATA FROM THE AUDIOMETRIC EVALUATION

Sensorineural hearing loss tendency with synchronization of hearing loss between left and right ear, distributed as follows: slight to moderate hearing loss, neuritis hearing loss – 1st, 2nd and 3^d degree.

Histograms shown are according to age and duration of employment. (3&4)



There is a marked tendency towards early positive response to above-threshold tests. A recruitment phenomenon during above-threshold audiometry is present, even before the manifestation of an audiometric curve with affected high frequencies (4000 Hz). Exacerbated sensitivity in this range indicates possibility of disrupted hearing function. In our opinion this fact is of significance in the early

diagnosis of noise induced cochlear neuritis. As a rule, in the group of workers investigated, the differentiation threshold for expansion of two intensities (Luscher-Zwislocki test) has low values (0.3-0.5 dB); high values are observed in workers with longer employment and a sharp reduction in hearing. The SISI test is also positive in over 60 percent of the cases and the Carhart and Kietz tests indicate impaired adaptation and re-adaptation and early hearing fatigue.

DATA FROM THE EVALUATION OF THE VESTIBULAR ANALYZER

The data from the evaluation of the vestibular analyzer include:

- Spontaneous vestibular symptoms – 1.4% in group I and 0.8% in group II
- Latent vestibular nystagmus – 26% in group I and 9% in group II
- Positive Romberg test (55%)

During the other statokinetic tests deviations were observed in 35 % from group I – of

Group I

- Hyperreflexia – 10%
- Normoreflexia – 40%
- Hyporeflexia – 50%
- Areflexia – 0%

Group II

- Hyperreflexia – 19.5%
- Normoreflexia – 62.5 %
- Hyporeflexia – 13.7%
- Areflexia – 3.7%

The KKG evaluation resulted in deviations in 18% of the contingent studied.

The average longitudinal raising in group I is 117 cm and in group II – 120 cm. The deviation from the maximum normal value is 5% in group I and 13.6% in group II.

The average lateral raising in gr. I is 15 cm and in gr. II - 16.8cm. The deviation from the maximum normal value is 4.3% in gr. I, and 11.2% in gr. II. The impairments in the vestibular apparatus in the contingent studied were significantly more pronounced when subjected to combined noise and vibration effects, primarily with vibrations of a general nature, and most often with hyperreflexia under provocation.

CONCLUSIONS

A significant percentage of impairments of the hearing function (52.6%, of which 20.4% professional hearing neuritis).

The early signs of hearing impairment are manifested typically at 3000, 4000 and 6000 Hz, but with a tendency for lower frequencies to be also affected. Sound traumatism due to noise and vibrations is characterized with hearing impairment, purely of a sound reception type, bilateral and symmetric, manifested in the high frequencies range.

Above-threshold tests are of importance for early diagnosis of professional hearing neuritis.

peripheral type and 30% of a central type. The Fukuda stepping test resulted in:

- Insignificant deviations – raising within first circle (50cm) – in 42% from group I and 30% from group II
- Significant deviations – raising above the limits of first circle – in 18% from group I and 32% from group II.

All deviations are on the side of the slow component of the nystagmus.

Extension of the time of exposure factor to over 10 years in respect to manifestation of hearing neuritis.

Suppression of the sensitivity of the Vestibular apparatus (depression of the nystagmus reaction) when subjected to noise and vibration impacts over an extended time period, with predominance of peripheral impairments. Desirability of simultaneous evaluation of the hearing analyzer and vestibular apparatus (from receptor to core manifestations) in work fitness assessments.

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