Noise-induced hearing loss for maritime navigating personnel

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Abstract: - Particularities of professional stress to the maritime navigating personnel are in accordance with the work environment, exposure to intense noise and vibrations, associated with periodicity and duration of embankments, length of service and the actual working time on board of vessels. In our study we have tried to correlate the level of hearing impairment with the intensity of noise for maritime navigating personnel, on different types of marine vessels (oil, container, ro-ro and cargo). Hearing impairment is directly correlated with intensity of noise and duration of exposure to hazards.

Key-Words: - noise, navigating personnel, hypoacusia, professional deafness

1 Introduction

Professional exposure to noise higher than 87 dB can lead to diseases (hypoacusia, professional deafness through sound trauma) but, in the same time, also to diseases related to profession (high blood pressure, digestive diseases, neuroses).

The measured values of sound intensity within vessel compartments (engine room, main deck) are different with a higher level in the engine compartment ($L_{EX,8h} = 87$ dB(A)).

According to International Standard Organization, professional noise is defined as a complex of sounds with various intensities and heights, with different, rhythmical or arhythmical characteristics, produced continuously or discontinuously, by machines, instruments, devices, human voice, during professional activity.

Particularities of professional stress to the maritime navigating personnel are in accordance with the work environment (different for those working at engines and those dealing with navigation on board of the vessels), exposure to intense noise and vibrations, associated with periodicity and duration of embankments, length of service and the actual working time on board of vessels.

2 Material and method

The survey concerns a batch of 130 navigators (deck and engine crew), selected according to the level of exposure to noise and length of service on the basis of an anamnestic questionnaire that applies to the persons exposed to noise and vibration.

This study concerns a batch of subjects that work on board of the vessels (maritime navigating personnel), selected according to the level exposure to noise, vibrations and length of service on the basis of an anamnestic questionnaire that applies to all persons exposed to noise and vibrations.

Risk factors have been studied: exposure to professional emissions, pathological case history related to disorders at the level of the middle ear and administration of toxic medication, neuropsychical...
symptomatology and subjective tolerance to noise. Noise level was measured on board of four types of vessels within commercial marine (general cargo, container, RO-RO, barge tank) during voyages at sea and values that exceeded 87 dB (A) in some of the vessels compartments were registered. The survey was carried out on a batch of 130 navigators (deck and engine crew) attention being paid to: pathological case history, length of service, actual working time on board of vessels, periodicity of embarkation and shifts. The etiological factors that favor the development of hypoacusia are: age, length of service and the actual working time on board of the vessels, pre-existing disorders of the middle ear, alcoholism, fatigue of the acoustic reflex, toxic emissions. The average exposure duration until the development of the professional hearing disease is of 14 years. [1, 3]

Professional hypoacusia is defined as the permanent drop of the sound threshold at a frequency of 4000 Hz with over 30 dB including, after applying the presbiacusia correction. It is a perception type hypoacusia, generally bilateral and symmetrical, with no interest in conversational frequencies, of professional etiology.[4]

3 Results
In our study we have tried to correlate the level of hearing impairment with the intensity of noise for maritime navigating personnel, on different types of marine vessels (oil, container, ro-ro and cargo).

Correlations between exposure to noise and hearing status of seafarers on seagoing vessels oil type. The study of nine subjects in deck crew personnel revealed that they are exposed to environmental noise level of 87.25 ± 1.089 dB. Of these, five subjects (55.55%) had normal hearing, two subjects (22.22%) mild unilateral hearing loss, a subject (11.11%) bilateral mild hearing loss and one subject (11.11%) average hearing loss unilateral. Regarding the type of hearing loss, two subjects (50%) had hearing loss of perception and two subjects (50%) mixed deafness. (Figure 1)

The study of 13 subjects in a group engine crew revealed that they were exposed to average noise level of 104.75 ± 7.36 dB. Of these, three subjects (23.08%) had normal hearing, one subject (7.69%) unilateral mild hearing loss, one subject (7.69%) bilateral mild hearing loss and one subject (7.69%) average hearing loss unilateral. Regarding the type of hearing loss, two subjects (50%) had hearing loss of perception and two subjects (50%) mixed deafness.

Our study reveals a direct correlation to the mechanical staff between frequency noise and hearing disorders and the other groups the correlation is irrelevant, for reasons of less stringent selection criteria (maintenance personnel or the auxiliary), or from a summation of stress factors (noise, vibration, mechanical/ climatic factors, pollution etc.).

Correlations between noise exposure and hearing status of the crew on sea ro-ro vessels. Lot deck crew was exposed to environmental noise level of 88.5 ± 1.118 dB. From the eight subjects, six was no subject with transmission hypoacusia, in turn seven subjects (43.75%) had hearing loss in the perception and nine subjects (56.25%) mixed deafness.

![Fig.1. Characteristics for hearing loss (oil vessels)](image-url)
subjects (75%) had normal hearing and two subjects (25%) had mild unilateral hearing loss and mixed type. (Figure 2)

The 10 subjects from the engine crew were exposed to average noise level of 105.25 ± 2.94 dB. Of these, three subjects (30%) had normal hearing, two (subjects 20%) bilateral mild hearing loss, two subjects (20%) average bilateral deafness and three subjects (30%) bilateral average hearing loss and, concerning the type of hearing loss, 5 subjects (71.42%) suffered from perception deafness and two subjects (28.57%) of mixed hearing loss.

The batch of maintenance crew has been exposed to average noise level of 105.75 ± 5.53 dB. Of these, three subjects (30%) had normal hearing, two (subjects 20%) bilateral mild hearing loss, two subjects (20%) average bilateral deafness and three subjects (30%) bilateral average hearing loss and, concerning the type of hearing loss, 5 subjects (71.42%) suffered from perception deafness and two subjects (28.57%) of mixed hearing loss.

One subject (age 34 years, of 11 years old in profession and a smoker, who presented a otology pathological personal history, conditions of ototoxic treatment) belonging to handle personnel, exposed to an average noise level of 101 ± 4.30 dB, presented mild bilateral hearing loss, perception type.

Auxiliary lot crew (four subjects) was exposed to an average noise level of 69.25 ± 0.83 dB. Among them, two subjects (50%) had normal hearing, one subject (25%) and a unilateral mild hearing loss, one subject (25%) unilateral deafness, and about the type, one subject (50%) had perception type deafness, one subject (50%) mixed type deafness.

The batch deck crew, represented 7 subjects were exposed to an average noise level of 87.75 ± 0.83 dB. From these, five subjects (71.42%) had normal hearing and two subjects (28.57%) suffered from mild unilateral hearing loss and mixed type. The 14 subjects in group engine crew, have been exposed to an average noise level of 102.5 ± 1.23 dB. Of these, three subjects (21.42%) had normal hearing, one subject (7.14%) had mild unilateral hearing loss, two subjects (14.28%) medium unilateral deafness, five subjects (35.71%) medium bilateral deafness and a subject (7.14%) unilateral severe hearing loss (Fig.3.), and as type of hypoacusia, four subjects (36.36%) had perception deafness and seven subjects (63.63%) mixed deafness.

Correlations between noise exposure and hearing status on maritime vessels crew cargo type (Figure 3).
4 Conclusions
This class of seamen is exposed to adverse effects of noise and, depending on the intensity (> 85 dB (A), may alone or in combination with other factors to determine a large proportion (40% overall), of hearing impairment.

For the deck crew of ships, in addition to noise exposure (> 85 dB (A)) is added stress caused by the responsibilities and major character decision states, for them, it is associated and added, a psycho-physical stress.

For the engine crew (noise intensity is > 85 dB (A), near the engine just > 100 dB (A), which is assigned in proportion to other factors than physical or chemical), we found damages to the auditory system in the highest proportion, and could speak of a true hearing stress.

In relation to the type of ships, the hearing system was damage in the highest proportion for ships and other associated pollutants, in addition to high-intensity noise (petroleum).

In general, hearing impairment is directly correlated with intensity of noise and duration of exposure to hazards. Adverse effects of noise on the body associated with a number of factors such as individual age (directly proportional relationship between crew exposure to noise and hearing impairment) psychological personality type (type of subjects with psychological personality type introverted, presented most of hearing impairment), the existence of risk factors with oto- and neurotoxic actions (smoking, coffee and alcohol consumption).

References: