

## Occupational Noise Induced Hearing Loss in Motor Boat Fisherman

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### ABSTRACT

**Introduction:** Noise Induced Hearing Loss is a person's hearing loss either partially or completely which is permanent and can affect one or both ears caused by continuous exposure to noise in the work environment. One of the causes of Noise Induced Hearing Loss (NIHL) is working as a motorboat fisherman.

**Content:** NIHL can arise as a result of the interaction between genetic factors and environmental factors with the role of internal and external risk factors. The diagnosis of NIHL can be established through history taking, physical examination such as otoscopy and tuning fork tests, as well as supporting examinations in the form of pure tone audiometry.

**Conclusion:** NIHL will produce the impression of sensorineural deafness with a permanent nature so that the only treatment that can be given is supportive and preventive management.

**Keywords:** Noisy; noise-induced hearing loss; motorboat fisherman



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## Introduction

Noise-induced hearing loss is a hearing loss due to noise that exceeds the threshold value<sup>1</sup>. Noise with an intensity of 85 decibels (dB) or more has the potential to cause damage to the auditory receptors of the organ of Corti in the inner ear. NIHL has symptoms that can be unilateral or bilateral. This disease can cause a lack of concentration, headaches due to disturbances in the nerves that regulate hearing function, difficulties in processing sound sources, sleep disturbances, the impact of job loss.<sup>1,2</sup>

In general, NIHL can be caused by exposure to high and continuous noise associated with the work environment. Various types of work can result in noise exposure such as work in the industrial sector to fisherman. As an area that is rich in underwater natural potential, it is not uncommon for Indonesians, in especially coastal areas, to have a livelihood as fisherman. With this, it can increase the risk of the high incidence of NIHL in fisherman, especially those who still use motorboats. Therefore, it is very important for the community to understand NIHL so that they can take precautions to overcome this problem.

## Definition

Noise Induced Hearing Loss (NIHL) or Occupational Noise Induced Hearing Loss is a person's hearing loss either partially or completely that is permanent and can affect one or both ears caused by continuous exposure to noise in the work environment. The NIHL incident has the principle that the higher the intensity and duration of noise exposure, the more severe the degree of NIHL caused. Hearing loss due to noise in the workplace can occur at noise intensities reaching 79 - 85 dB.<sup>3</sup>

## Epidemiology

The incidence of NIHL in Indonesia is quite high. Indonesia's geographical location has a major influence on the incidence of NIHL because most of its territory is water so the number of people who work as fisherman is also large. There is a study conducted at the Ketapang-Gilimanuk crossing by examining pure tone audiometry, it was found that 34.85% of ship engine operators were deaf due to noise (NIHL). This study also said that workers who did work >40 hours/week experienced a 7.33 times greater risk of sensorineural hearing loss.<sup>4</sup>

## Risk Factor

Several risk factors influence the incidence of *NIHL*, including noise intensity, frequency, length of exposure per day (increased if > 8 hours per day), years of service (increased if > 10 years), individual vulnerability, age (increased if > 50 years), gender (men have 3 times greater risk than women), and other risk factors. Based on the regulation of the minister of labor of the Republic of Indonesia, the noise

threshold value is 85 dB with an exposure time of 8 hours. At a noise value of 140, workers should not be exposed to noise at that value even for a short period of time. In the occurrence of NIHL, there are also internal and external risks for each individual who collaborates with noise exposure. Internal factors that influence include atherosclerosis, hypertension, middle ear disorders and the aging process while external factors include abnormal temperature, vibration, drugs, or ototoxic substances.<sup>2,5</sup>

### **Etiology**

Noise-induced hearing loss can be caused by a single exposure to a very high frequency such as an explosion, or it can also be caused by continuous exposure to noise at a relatively lower intensity over a long period, such as ferry operators, motorboat fisherman and other workers factory. The principle of the occurrence of NIHL is that the louder the noise exposure received, the shorter the time required for NIHL to occur.<sup>4,6</sup>

### **Pathophysiology**

NIHL can occur due to a combination of genetic and environmental factors. WHO recommends a relatively safe environmental noise level, which is below 70 dB for 24 hours or below 89 dB for more than five hours in a week. Noise exposure has different energy levels depending on the intensity and duration of sound exposure. According to JISA 2018, noise exposure on motorized boats has different levels depending on the type of engine, the speed of the boat, and the duration of the engine flame used. When the boat runs at a speed of 4 knots of 0.5 hours, the average noise value is 70 dB. If the boat is traveling at a speed of 8 knots and a duration of 4 hours has an average noise value of 73 dB (6-10)

Exposure to high energy levels of noise can cause a temporary increase in the hearing threshold. This condition can improve and return to normal within 24-48 hours. Although this can improve, it can cause damage to the hair cells in the ear even if it doesn't cause symptoms. If noise exposure occurs continuously. Then a temporary threshold increase can turn into a permanent one. Exposure to noise in the long term can cause damage to the ear and cause cell death. Excessive exposure to noise can also trigger psychological and physical stress such as increased blood pressure and increased pulse.<sup>7,10,11</sup>

### **Clinical Manifestations**

Clinically, exposure to noise in the hearing organ can cause an adaptation reaction, an increase in the hearing threshold that is temporary (temporary threshold shift) and an increase in the hearing threshold permanently (permanent threshold shift). Symptoms that can be found in NIHL include tinnitus (ringing in the ears), difficulty catching conversations (including difficulty communicating in crowded places), and decreased hearing.<sup>13</sup>

In addition to the effect on hearing (auditory), excessive noise exposure also has non-auditory effects such as difficulty in communicating, intellectual disturbances, sleep disturbances that can cause stress due to hearing loss.<sup>14</sup>

### **Diagnosis**

The diagnosis of NIHL is based on history, physical examination and investigations.<sup>15</sup> In the history, the patient can be asked about a history of working or working in an environment with exposure to high noise for a long time (> 5 years), a history of early onset of hearing loss (suddenly or slowly in one or both ears). In addition, patients are also asked whether hearing is lost in certain tones. After taking the history, it can be continued with a physical examination in the form of an otoscopy examination and a tuning or tuning fork test. The tuning fork test results in a positive Rinne, Weber lateralizes to the better-hearing ear and Schwabach shortens with the impression of sensorineural deafness. In addition, a supporting examination can also be carried out to confirm hearing by conducting an audiological evaluation. The audiological examination includes pure tone audiometry examination with air conduction (although it is subjective), pure tone audiometry examination with bone conduction, speech audiometry, and immittance. Pure tone audiometry examination found sensorineural deafness at frequencies of 3000-6000 Hz and at a frequency of 4000 Hz there is often a notch that is pathognomonic for this type of deafness.

### **Management**

NIHL disease is permanent and progressive so that it rarely or even does not require medical therapy. The main strategy that can be done is to prevent the worsening of the patient's condition and carry out rehabilitation in people who have been exposed to NIHL.<sup>14</sup> NIHL management must be done holistically and comprehensively.<sup>16</sup>

The simplest prevention that can be done is measuring noise. This procedure was carried out with the aim of assessing the maximum, average, minimum, intermittent type fluctuation and noise steadiness. The frequencies that are prone to causing damage to the organ of Corti in the cochlea are 3000 Hz - 8000 Hz. If exposure to high-intensity noise continues for a long time, it can cause hearing loss. After finding the source of the noise, this must be recorded and followed by measuring the time of exposure to noise. The higher the noise intensity, the relatively safe exposure time becomes shorter. This has been regulated in the Decree of the Minister of Manpower of the Republic of Indonesia no. KEP51/MEN/1999 concerning the threshold value of physical factors in the workplace. After taking the noise measurement, can be continued with noise control. This management can be done by minimizing the amount of noise at

noise sources such as noise reduction at the engineering control program stage (engineering control program), installation of silencers, engine insulation and sound-absorbing materials.<sup>16</sup>

Hearing examinations in workers with pure tone audiometry routinely can also be carried out to prevent the occurrence of NIHL. This examination consists of measuring the hearing function of employees before being accepted to work in a noisy environment (pre-employment hearing test), measuring the hearing function of employees during work, as well as people living in noisy environments. The hearing measurement process is carried out regularly and regularly every six months. It aims to get a basic picture of the hearing ability of workers and people in noisy environments. In the end, it will be known whether the place where the noise occurs can cause NIHL or even worsen the NIHL condition that has been suffered previously.<sup>16</sup>

Other treatments that can also be done are the use of simple protective equipment, such as earplugs and ear saddles as well as personal protective equipment (PPE). Apart from these ways, providing education to workers is the key to prevention. Before taking protective measures, a person must understand that they are at risk for NIHL and are obliged to take precautions. With this, it is very important to educate workers as an effort to prevent NIHL.<sup>18</sup>

After all the procedures have been carried out, the last step is recording all the processes that have been carried out. The purpose of recording is to evaluate the noise factor and determine the next step.<sup>16</sup>

## **Prognosis**

NIHL is a disease with a type of cochlear sensorineural deafness that has a permanent nature and cannot be treated with drugs or surgery, so the prognosis is not good. Therefore, the most important thing is the prevention of NIHL.<sup>17</sup>

## **Conclusion**

Noise induced hearing loss or occupational noise induced hearing loss is a person's hearing loss either partially or completely that is permanent and can affect one or both ears caused by continuous exposure to noise in the work environment. The incidence of NIHL is quite high in Indonesia, especially NIHL which affects motorboat fisherman. There are several risk factors for the emergence of NIHL including noise intensity, frequency, length of exposure per day, years of service, individual vulnerability, age, gender, and other internal and external risk factors. The basic pathophysiology of NIHL is a combination of genetic and environmental factors. The diagnosis of NIHL can be made by history taking, physical examination, and investigations. NIHL disease is permanent so that the treatment given is only supportive to prevent worsening and take precautions before getting NIHL. In this regard, NIHL disease has a dubia ad night prognosis.

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