NOISE INDUCED HEARING LOSS IN STEEL FACTORY WORKERS

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ABSTRACT

Noise induced hearing loss (NIHL) is a sensori-neural hearing deficit that begin at the higher frequencies (3000 to 6000 Hz) and develops gradually as a result of chronic exposure to excessive sound level. It is mostly found in the developing and industrial countries workers. The objective of this study was to prove that chronic exposure noise of machine could lead to NIHL on steel factory workers. A cross section study of 50 steel factory workers in Sidoarjo of East Java was done during the periode of January to June 2004. The method of this study included: interview, noise measurement in the steel production machine room and in the adminitration room , ENT examination and hearing test with audiometer of 50 workers. This sample divided into two groups, a group of 25 workers of the steel production machine division as case group, and another 25 workers of the administrative division as control group. The results of this study was as follows: The noise intensity in the steel production machine room was 102 dB and in the administration room was 60.4 dB and a number of 21 workers (84 %) of the case group got NIHL, compared to 1 worker (4 %) of the control group. There was a significant difference in the incidence of NIHL between the two groups. There was also a significant difference in correlation between NIHL and working period ($p < 0.05$).

***Keywords**: noise induced hearing loss, sensorineural hearing loss*

INTRODUCTION

Noise induced hearing loss (NIHL) is a sensori neural hearing loss as a result of chronic exposure to excessive sound in long period. It is mostly found in the developing and industrial countries with bad hearing conservation (Sumento and Zizlavsky, 2003). Result of a public health survey in the United States in 1962, 8.4 % of adult citizen have hearing level > 25 dB. They guessed the hearing loss due to exposure of noise (Suter, 1979). Hendarmin (1971) reported 50 % of workers at a manufacturing plant Pertamina and two ice factories in Jakarta had NIHL. Suheryanto (1994) reported 71.43 % of workers at textil factory in Surabaya had NIHL.

Factors that influences NIHL are age, hereditary and systemic diseases, infection of middle ear, ototoxic drugs, race, fatique, smoke (Alberti, 1991; Mizoue, 2003). No medical or surgical treatment to cure NIHL. The most important is to prevent NIHL with noise protector or reduced noise exposure. In Indonesia, according to the decree of Minister of Manpower No. SE 01/Men/ 1978, it is regulated that the maximal noise intensity level in working area not more than 85 dB. In addition, working time should not be more than 8 hours/day or 40 hours/week, and if noise intensity level more than 85 dB, the management must take preventive actions to decrease noise induced hearing loss by using ear plug, ear muff or helmet with ear muff, or by reducing working time. However, the problems are many workers reluctant to use ear protection, and the cost is relatively expensive.

MATERIAL AND METHOD

This was an epidemiological comparative cross-sectional study. This study was done at the department of ENT Dr.Ramelan navy hospital and at the steel factory in Desa Janti, Waru, Sidoarjo, East of Java, during period of January to June 2004. Sample were taken from population with simple random sampling and devided into two groups. Samples with noise induced are workers in the steel production machine division as case group and control group is workers in the administration division.

The inclusion criteria were workers who had been working at the factory minimal 6 years continously, aged 20 - 45 years, and agreed to joint this study. The exclusion criteria were workers who previously worked in noise induced area in other place, workers with brain injury, middle ear infection, ototoxic medication, systemic disease, hereditary hearing loss, heavy smoker and alcohol drinker.

RESULTS

There were 25 workers in the steel production machine division as case group and 25 workers in the administration division as control group.

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Table 1. Noise intensity in the production machine room and in the administration room

Location	Intensity (dB)	
	Production machine room	Administration Room
North side	104	60
South side	108	62
East side	108	65
West side	100	55
Rest room	90	55
Average	102	60.4

This table shows that noise intensity in the production machine room is higher than 85 dB (maximal intensity level), while noise intensity in the administration room is lower than 85 dB.

Table 2. Age distribution and working period

	Case group (25)	Control group (25)
Age (average)	37.80	36.12
Working period (average)	16.72	13.56

With t-test for independent samples for age average, $p = 0.254$ ($p > 0.05$). There is no significant difference in the age of two groups. With the same test for working period, $p = 0.053$ ($p > 0.05$) so there is no significant difference in working period of two groups.

Table 3. Audiogram of the case group and control group

Audiogram	Case group	Control group
Normal	1 (4%)	20 (80%)
NIHL	21 (84%)	1 (4%)
Sensori neural hearing loss (non NIHL)	3 (12%)	4 (14%)
T o t a l	25 (100%)	25 (100%)

With Chi-Square test , $p = 0.000$. ($p < 0.05$), there is a significant difference between two groups in the incidence of NIHL.

Table 4. Relation beetwen working period and NIHL on the case group.

Working period	Audiogram		Total
	NIHL	Non NIHL	
6 – 10	2 (40%)	3 (60%)	5 (100%)
11 – 15	7 (87.5%)	1 (12.5%)	8 (100%)
16 – 20	3 (100%)	-	3 (100%)
> 20	9 (100%)	-	9 (100%)
Total	21 (84%)	4 (16%)	25 (100%)

With Mann - Whitney test, $p = 0.009$ ($p < 0.05$), there is a significant difference in relation beetwen working period and NIHL in the case group.

DISCUSSION

This study was held in a steel factory at Desa Janti Sidoarjo Province of East Java. This factory occupied 117,775 m square area with 661 workers. Totally 268 persons worked in production machine division and 85 persons worked in administrative division. This factory had regulation that workers in production machine division had to use ear protection, but almost all of them were reluctant to use it. Table 1 shows that average noise intensity in production machine room is 102 dB. It is higher than 85 dB. This is the maximal noise intensity level where workers can work 7-8 hours per day or 40 hours per week (Ward and Duval, 1971). In the area with noise intensity of 102 dB, long or continuous exposure should be no longer than 1.5 hours per day (Rasyid, 1985). In this factory, workers in production machine division work 7 hours per day or 48 hour per week. These factors cause noise induced hearing loss on workers.

Table 2 shows age and working period distribution. Average age of case group is 37.80 year and control group is 36.12 year. Average working period of case group is 16.76 year and control group is 13.68 year. Age and working period of case group and control group has no significant difference. For age $p = 0.254$ ($p > 0.05$) and for working period, $p = 0.053$ ($p > 0.05$). Table 3 shows result of audiogram in case and control group. Twenty-one (84 %) workers in case group had NIHL and only 1 (4 %) in control group had NIHL. There is a significant difference between two groups in the incidence of NIHL with $p = 0.000$ ($p < 0.05$). One worker in case group had normal audiogram because he was a technical engineer and he always used ear plug during work in the noise exposure area.

The ear plug reduce noise exposure 25 dB in low frequency and 40 dB in high frequency (Iskandar, 1974; Melnick ,1978 ; Alberti , 1991). The high incidence of NIHL in this factory due to bad hearing consevation program. According to ministerial regulation No. SE 01/MEN/1978 mentioned that factory where noise intensity up to 85 dB must to have hearing conservation program (Rasyid, 1985). Compare to other author, Hendarmin (1971) got 50 % NIHL on workers in ice and manufacturing plant factory with noise intensity 75 - 110 dB. Suheryanto (1994) reported 71.43 % NIHL in workers of textile factory.

Table 4 shows relation bettween working period and NIHL on the case group. In this study there was a significant difference in relation between working period and NIHL on the case group. Incidence of NIHL increases equal with the increase of working period. Hidayat (1991) reported incidence of NIHL on workers of textil factory in Malang 17.20 % with 10 years working period and 46 % with 15 years working period. Suheryanto (1994) reported 44.44 % with 5-9 years working period, 66.67 % with 10 - 14 years and 85.91 % with 15 - 19 years.

CONCLUSIONS

1. The noise intensity in the production machine room was 102 dB and in the administration room was 60.4 dB.
2. A total of 21 workers (84 %) of the case group got NIHL, compared to only one worker (4 %) in control group. There was a significant defference in the incidence of NIHL between the two groups.
3. There was a significant difference in correlation between NIHL and the working period.

RECOMMENDATIONS

1. Factory with noise intensity above maximal noise intensity level (85 dB) must have noise conservation program:
   a. Use ear plug continously during work.
   b. Sound proof room for rest.
   c. Health education about noise induce hearing loss.
2. Hearing test (audiogram) before work in the factory.

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