

Surveillance of Occupational Noise-Induced Hearing Loss: The Current Situation in Thailand

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Abstract

During 2011-2015, 101 cases of occupational noise-induced hearing loss (ONIHL) were diagnosed in Thailand. Among them, 37 cases were compensated by the Thai compensation fund. This is a case report to reflect the Thailand situation of ONIHL in occupational settings. Only a few companies in Thailand have adopted the annual audiometric test with baseline audiograms and retests, refer their employees to occupational physicians to diagnose its feasibility of occupational disease. Proper baseline revisions were not performed, which resulted in over-investigation (retests) and unnecessary referrals.

Screening protocols for Hearing Conservative Programs (HCPs) were not performed properly. Occupational noise-induced hearing loss is extremely under diagnosed in Thailand.

Keywords: Audiometric test, Noise-induced hearing loss, Occupational Health, Occupational noise, Significant threshold shift, Thailand

Introduction

Hearing loss is one of the most frequent chronic sensorineural injuries in the world. A significant proportion of workers have been exposed to hazardous noise levels which has increased the number of workers with occupational noise-induced hearing loss (ONIHL).[1,2]

During 2011-2015, there were 101 cases of ONIHL diagnosed in Thailand. Only 37 cases were compensated by the Thai compensation fund.[3-7] In 2015, only 3 cases of ONIHL were reported (table 1), although there are nearly 10 million workers registered in Thailand.[3] In contrast, Singapore reported that noise-induced deafness was a leading cause of occupational disease, with nearly 300 cases recorded in 2016.[8] Noise-induced deafness has been the leading occupational disease diagnosed in Singapore since 2007. In Thailand, ONIHL is clearly underdiagnosed; there is also a lack of awareness in occupational settings, which might be the result of the poor knowledge regarding Hearing Conservation Programs (HCPs).

The Bureau of Occupational and Environmental Disease (BOED), which is under Department of Disease Control, Ministry of Public Health, Thailand reported that, among 15,427 workers in 2016, 4,940 (32%) employees were suspected of being in an early stage of ONIHL, and 2,312 employees (15%) showed abnormal hearing results.[9] However, these numbers do not represent the complete situation in Thailand, as private health care providers in Thailand have no mandatory reporting systems of ONIHL cases to the BOED. Therefore, this case report emphasized the current situation of hearing loss in occupational settings in Thailand. The study was approved by the Human Research Ethics Committee of Rayong Hospital, Rayong, Thailand (RYH 8/2560).

Case

A male worker accompanying with the company safety officer presented at the occupational clinic at Rayong hospital, Thailand, for assessment of ONIHL in August 2016. The subject was 32 years old and had worked at a petrochemical company since 2007; his primary job task for the

past several years had been bagging and transporting plastic granules. He had slightly decreased hearing sensation at high frequencies in both ears. The screening audiometric test at the company showed that his hearing in 2016 was worse than his baseline in 2010 according to National Institute for Occupational and Safety Health (NIOSH) criteria (Significant Threshold Shift).[10] The subject controlled a plastic granule palletizer machine in a 12-hour shiftwork with 3 workdays and 2 days off between 2010 and 2011. He sometimes visited the office during shiftwork. Personal protective equipment (PPEs) was provided by the company. Compliance of PPE usage was not recorded. The subject has been relocated to a bagging operation work station, which was not noisy area, since 2012. Hearing loss was not detected in his 3 co-workers by annual audiometric test. In 2010-2011, the subject worked a night shift at a noisy place for 6 hours per night, 15-20 nights per month. He had visited noisy places at night only a few times since 2012.

The confirmation audiometric test was conducted at the occupational clinic at the Rayong Hospital. Air and bone conduction tests were performed to rule out conductive hearing loss and mixed hearing loss. The confirmatory audiometric test result suggested sensory hearing loss.

The early NIHL sign was shown by a U-shaped notch at 3000 and 4000 Hz in both ears.

A walk-through survey at the petrochemical plant was performed by an occupational physician, an occupational health nurse, and a public health officer to identify occupational health risks in the subject's work stations and to confirm the diagnosis of ONIHL. During the walk-through survey, the health officials were also accompanied by the subject, safety officers and the plant manager from the company. The noise exposure history was provided by the company safety officer. Both a sound level meter and a noise dosimeter were used for analysis (table2). In 2013-2015, exposure to noise louder than 80 dB(A) in the bagging department was considered to result in an early stage of NIHL.[11]

The audiometric analysis showed that a significant threshold shift occurred only once for each ear in 2011. No audiometric retest was performed in 2011. The hearing loss in both ears had not progressed since 2011. However, the petrochemical company considered the results in 2016 as

a significant threshold shift without a proper baseline revision. Audiometric tests were performed in 2013 and 2014 without a significant threshold shift from the revised baseline (the 2011 results for each ear).

The safety officer understood that the criterion for comparison of audiometric tests, by Thailand law, requires a 15 dB or more change in each frequency (500-6,000 Hz) of either ear to identify a “significant threshold shift (NIOSH)”.[12] However, the safety officer did not recognize the baseline revision criterion for a significant threshold shift. By comparison, the current result (2015) with the non-revised baseline (2010) showed a 15 dB shift at 3000 Hz and 4000 Hz of the right ear. With a proper baseline revision, this yearly audiometric result showed no significant change in 2015. The 15 dB shift in 2011 should not be considered a work-related shift, because the subject worked with the palletizer machine which has a noise level not loud enough to cause hearing loss. The subject also reported that his night life style during 2010-2011 exposed him to high levels of noise and alcohol. Therefore, this case should have been sent to an occupational clinic in 2011, and the diagnosis should not be occupational noise hearing loss. Using the guidelines of 2015, the subject would not have been referred to an occupational clinic if the proper baseline revision had been performed annually.

Prevention and control measurement

Occupational noise exposure over 80 dB(A) can result in early NIHL, but it is unlikely to progress further in the current case if noise exposure is less than 85 dB(A) in a hearing conservation program. However, an annual audiometric exam should be performed for the current case in order to determine the noise reduction needed to achieve a noise level less than 80 dB(A).

Discussion

Only a few companies in Thailand have a program including annual audiometric tests with baseline audiograms and send their employees to visit occupational physicians at occupational clinics.

In Thailand, the hearing conservation program (HCP) is legally provided by employers for those who are exposed to noise greater than 85 dB(A) over a time weighted average (TWA).[12] Because noise louder than 80 dB(A) can result in early NIHL,[11] some companies extend the program to those exposed to noise greater than 80 dB(A) TWA. Audiometric tests must be performed annually for all workers under the program. Annual audiometric tests must be legally compared with a baseline audiogram using NIOSH criteria (significant threshold shift).[10] However, only a few companies in Thailand understand the importance of this baseline revision. In the current case the subject should have visited the occupational clinic to assess the work-relatedness of his hearing loss in 2011; such an assessment could have provided the subject with a retest audiogram. His work-relatedness assessment results from 2011 would have shown early NIHL that was likely lifestyle rather than work-related. With a proper baseline revision, the subject would not have needed to visit the occupational clinic for his abnormal results in 2015. In addition, the subject would not have needed the audiometric retests in 2013 and 2014. A high proportion of companies in Thailand have used the OSHA criteria (standard threshold shift) as a substitution or in combination with NIOSH criteria. Compared to the significant threshold shift (NIOSH criteria), standard threshold shift (OSHA criteria) is more specific to occupational noise NIHL.[13,14] Furthermore, age-corrected standard threshold shift might be useful for a differential diagnosis of presbycusis in aging workers. OSHA criteria could reduce the results considered abnormal in a hearing test by half. However, in this case, both significant threshold shift and standard threshold shift required a work-related assessment which was reported in 2011.[15,16]

The Thai compensation funds' diagnostic criteria for ONIHL introduced in 2007 did not match a diagnosis of early ONIHL.[11,17] For diagnosis by the compensation fund, an employee must be exposed to noise greater than 90 dB(A) during an 8-hour TWA for at least 1 year or 40 weeks per year for at least 3-noise exposed workdays per week. The Association of Thai Occupational Physicians established a guideline for a diagnosis of ONIHL.[18-22] Unfortunately,

the compensation fund committee refused to adopt the guideline, instead using its own criteria, which are not accepted by the Association of Thai Occupational Physicians.

The guidelines typically used by occupational physicians in Thailand are those of Coles and Wilson.[19, 23-28] These criteria should be combined with notch criteria for use by the Thai compensation fund. However, notch might be difficult to identify in Thailand, because some health care providers do not use audiometric tests at an 8000Hz or 3000 Hz frequency for annual screening audiometric test because of the financial burden.

Proper baseline revisions must be performed by occupational physicians who have experience in hearing conservation programs in order to prevent misunderstandings regarding the incidence and prevalence of standard threshold shift and significant threshold shift.[29,30] Noise and ototoxic chemical exposure history are crucial in diagnosing work-related NIHL for those who experience hearing threshold shift.[31]

The Thai compensation fund's diagnostics criteria could be modified to include noise exposure to 80 dB(A) for early NIHL and to change its current guideline of exposure for 6 months to noise greater than 93 dB(A). In addition, bilateral hearing loss 25 dB(A) or more at 4,000 Hz for 2 consecutive audiograms should be considered for earlier diagnosis.[32] It is clear that ONIHL is under diagnosed in Thailand, and that ONIHL is not well recognized in occupational settings. Results of abnormal annual hearing tests in occupational settings should be reviewed by occupational physicians in order to recognize and prevent ONIHL.

Conflict of Interest

No potential conflicts of interest relevant to this article were reported.

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Table 1 Situation of Compensation Fund in Thailand 2011-2015

Year	Total Budget (Million Baht)*	Total Employers	Total Employees	Cases of ONIHL
2011	2,969	338,270	8,222,960	13
2012	2,868	342,084	8,575,398	28
2013	3,848	347,581	8,901,624	44
2014	4,220	352,961	9,132,756	13
2015	4,107	357,902	9,336,317	3

*1 US Dollar equals to 34.1 Thai Baht

Table 2 Sound level meter results from the subject's work stations

Year	Department	TWA dB(A)
2010	Palletizer	75.8
2011	Palletizer	75.8
2012	Bagging	61.9
2013	Bagging	83.56

2014	Bagging	84.1
2015	Bagging	82.89
