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CASE REPORT

Establishing Diagnosis of Occupational Noise-Related Hearing Disorder in Food Process Industry Worker: A Case Report

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ABSTRAK

Kami menghuraikan satu kes yang melibatkan seorang lelaki dewasa yang mengalami gangguan pendengaran bilateral pada tahap ringan hingga sederhana, berkait dengan pendedahan bunyi bising yang melampau di tempat kerja dan tidak mempunyai sejarah pendedahan bunyi bising dari faktor pekerjaan yang signifikan. Keadaan ini sering kali berlaku dalam persekitaran industri pengeluaran, namun ia menunjukkan pemantauan bunyi bising di tempat kerja yang tidak memadai, seterusnya menyumbang kepada keadaan berbahaya yang tidak diendahkan. Diagnosis gangguan pendengaran disebabkan bunyi bising pekerjaan (ONRHD), khususnya kehilangan pendengaran akibat bunyi bising (NIHL), sering kali tidak mematuhi garis panduan yang ditetapkan. Ramai pengamal klinikal dan doktor kesihatan pekerjaan tersilap dalam mendiagnosis kes sebegini, sekaligus menyebabkan pelaporan yang tidak tepat kepada Jabatan Keselamatan dan Kesihatan Pekerjaan. Dalam kajian ini, kami mencadangkan supaya latihan untuk doktor kesihatan pekerjaan dipertingkatkan bagi mengenal pasti ONRHD dengan lebih tepat, terutamanya NIHL bagi mengurangkan kesilapan melaporkan kes-kes yang bukan berpunca dari pekerjaan.

Kata kunci: *Doktor kesihatan pekerjaan; gangguan pendengaran disebabkan bunyi bising pekerjaan; kehilangan pendengaran disebabkan bunyi bising; pendedahan bunyi bising di tempat kerja*

ABSTRACT

We describe a case involving a male adult experiencing mild to moderate bilateral hearing impairment, linked to excessive noise exposure at his workplace, with no notable nonoccupational noise exposure history. This situation is frequently observed in industrial production environments, yet it reflects inadequate workplace noise monitoring, contributing to oversight of hazardous conditions. The diagnosis of occupational noise-related hearing disorder (ONRHD), specifically noise-induced hearing loss (NIHL), often deviates from established guidelines. Many clinicians and occupational health practitioners have misdiagnosed such cases, leading to inaccurate reporting to the Department of Safety and Health. In this study, we advocate for enhanced training of occupational health practitioners to accurately identify ONRHD, particularly NIHL, to minimise erroneous reporting of non-occupation-related cases.

Keywords: Occupational health doctors; occupational noise-related hearing disorder; occupational noise-induced hearing loss; occupational noise exposure

INTRODUCTION

Occupational noise-related hearing disorders (ONRHD) ranks among the most common occupational diseases. Chronic exposure to elevated sound levels in professional environments has emerged as a critical worldwide public health issue (Śliwińska-Kowalska & Zaborowski 2017). Persistent or sporadic auditory disturbances in occupational spaces exceeding 85 dB(A) across an eight-hour workday or abrupt sounds surpassing 120 dB(A) within the same interval, pose substantial risks.

On a worldwide scale, ONRHD accounts for roughly 16% of profound auditory deficits among adults, emphasising its contribution to considerable functional limitations rather than direct fatalities (Kerr et al. 2017). Updated assessments from recent research indicate this proportion could reach up to 22% of the overall hearing loss burden attributable to workplace factors. Within Malaysia, ailments encompassing noise-triggered auditory decline (NIHL), sensory hearing challenges and enduring threshold alterations represented the predominant notified work-linked malady in 2021, encompassing 3,648 occurrences (68.9%) (Department of Occupational Safety and Health 2021). Though these figures may not encompass the national landscape, they highlight the extensive influence on numerous Malaysian labourers. Contemporary investigations reveal varying occurrence rates from 5% to 82.6% across diverse sectors, underscoring an upward trajectory in such concerns (Abdul Razak & Mohd Aris 2024).

Key contributors to ONRHD vulnerability include deficient education and vigilance among staff, alongside lax implementation by oversight authorities. Moreover, auditory safeguards are commonly ill-suited or degrade over time, yielding diminished noise reduction in practical scenarios relative to controlled evaluations (Abdul Rahim et al. 2020; DOSH 2021; Neitzel & Seixas 2005).

Notwithstanding the annual escalation in documented episodes, substantial inconsistencies persist between submissions to Department of Occupational Safety and Health (DOSH) and substantiated findings after official reviews. The primary reason for this discrepancy is likely a knowledge-practice gap. Many clinicians diagnose NIHL based on clinical impression alone, without adhering to the specific guidelines mandated by DOSH for compensation purposes, which require a rigorous forensic approach to establishing causality. These reporting inaccuracies from businesses and healthcare professionals may arise from hurdles in interpreting concepts such as NIHL, permanent standard threshold shift (STS) and auditory deficits, coupled with obstacles in verification and proving occupational connections. As a result, this distortion elevates institutional illness metrics (notably ONRHD data) and hinders the efficiency of reimbursement procedures. This case report aimed to advocate for improved clinical training and reporting accuracy among occupational health practitioners in line with established guidelines for diagnosing ONRHD.

CASE REPORT

A 50-year-old male underwent an initial pure tone audiometry (PTA) assessment, revealing symmetrical impairment in higher frequency ranges and a transient threshold shift. The individual has been a process operator in a dairy manufacturing facility's production area for two decades. His role involved operating and monitoring high-speed filling lines, pasteurisation units and automated cleaning systems. These tasks were performed in enclosed environments with limited acoustic dampening, contributing to sustained noise exposure.

He is a habitual heavy smoker of 10 to 15 cigarettes per day, typically after working hours due to workplace restrictions on tobacco use. He had maintained this routine for over a decade, with no history of pre-existing long-term health conditions, prior trauma to the head or ears, or exposure to loud sounds outside of work. Examination of both ears using an otoscope yielded unremarkable results.

The occupational health physician contacted the employer regarding the initial audiometric

evaluation from 2018, noting the employee's tenure exceeding a decade. As per the company's spokesperson, awareness of noise hazards for this role emerged from an acoustic assessment in 2016. Screenings were halted amid the COVID-19 outbreak, prompting a subsequent noise evaluation due to concerns over the inadequacy of earlier measurements.

This later assessment indicated an average 8-hour noise exposure level (Lex) of 85.7 dBA and a personal daily noise dosage of 117.8%. The worker demonstrated inconsistent adherence to using ear protection gear due to discomfort and communication barriers. He also had not participated in any auditory safety workshops as the provision of mandatory auditory safety training for workers was only formally established as a requirement after the Occupational Safety and Health (Noise Exposure) Regulations in 2019.

Three months later, the physician arranged a follow-up PTA, who also directed the patient to an otolaryngologist for confirmatory testing. Ultimately, the diagnosis confirmed mild to moderate bilateral nerve-based auditory deficit, classified as an occupation-linked noise-associated hearing condition. Recent data from Malaysia highlight an escalating pattern in such disorders, with DOSH documenting more than 5,000 instances related to workplace noise within the first half of 2023 alone. The physician promptly informed DOSH and the employer within a week of finalising the diagnosis. Additionally, the employee received guidance on participating in noise mitigation initiatives and the critical role of correctly utilising protective hearing equipment. The repeated PTA result and bone conduction with masking were shown in Figure 1 to 4.

DISCUSSION

The case analysis indicated that the worker's contact with job-related acoustics surpassed established exposure thresholds. Furthermore, the individual lacked any notable background of chronic illnesses, contact with harmful chemicals, or auditory hazards beyond the professional setting.

Audiometric evaluations displayed characteristic patterns of occupation-linked noise-triggered auditory decline, featuring symmetrical deficits in elevated frequency bands. Initial diagnostic efforts were imprecise, failing to align with the stipulations outlined in Malaysia's Occupational Safety and Health (Noise Exposure) Regulations of 2019, even though evidence from occupational sound levels, physical assessments and hearing test outcomes pointed toward a clear connection.

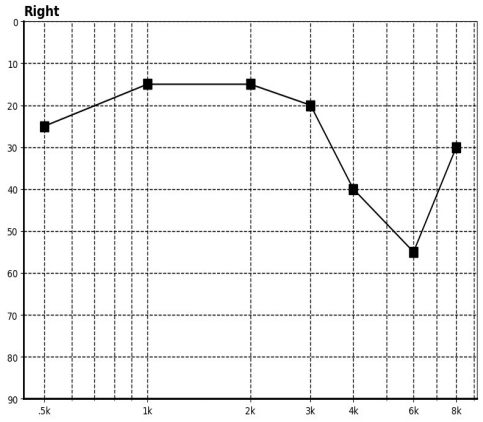

FIGURE 1: The repeated PTA result with masking (right ear)

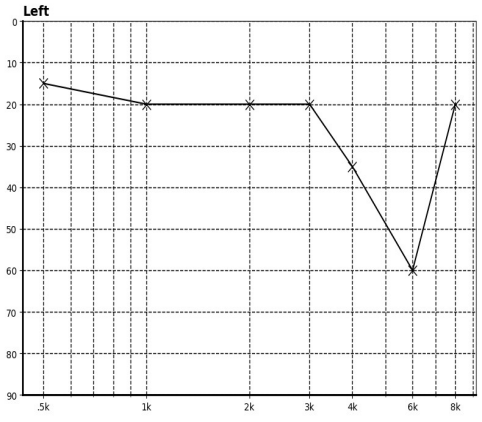

FIGURE 2: The repeated PTA result with masking (left ear)

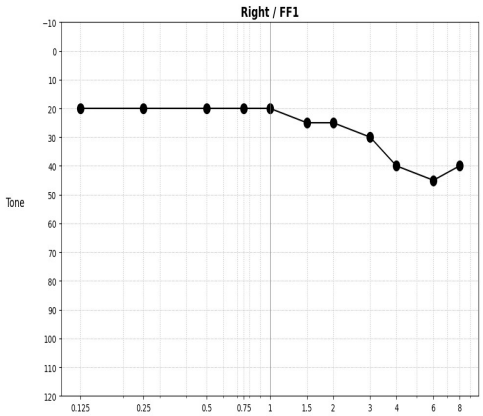

FIGURE 3: The repeated bone conduction with masking (right ear)

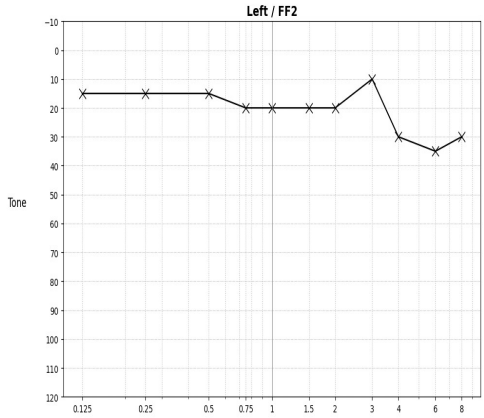

FIGURE 4: The repeated bone conduction with masking (left ear)

Diagnosis of Occupational Noise-Related Hearing Disorders

Prolonged interaction with intense sounds can inflict irreversible harm on hearing mechanisms, leading to lasting alterations in detection thresholds and diminished auditory function. To accurately pinpoint noise-triggered auditory impairment (NIHL), healthcare providers need a solid grasp of potential influencers on sound-related hearing deficits and the underlying mechanisms of such damage. In Malaysia, Occupational health physicians are exceptionally equipped for ONRHD assessments, given their in-depth familiarity with the symptomatic and testing profiles of NIHL.

Diagnostic based on Audiometric Configuration

Standard pure tone assessment (PTA) serves as the benchmark method for evaluating NIHL, enabling determination of impairment category and extent (Dillon et al. 2016; Fredriksson et al. 2016). A whole diagnostic PTA is essential for ONRHD confirmation, incorporating air and bone pathway evaluations and selective sound masking to distinguish between transmission-based and neural-based deficits. Per Malaysia's 2019 Noise Exposure Regulations, testing must cover bands at 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz.

NIHL manifests as a neural-type auditory deficit marked by a dip in the 3-6 kHz range on hearing charts. Damage from acoustics often initiates in upper registers, especially around 3-6 kHz, but sustained exposure may extend to adjacent areas like 2 kHz, 1 kHz or even 8 kHz (Ali et al. 2015). As a result, NIHL commonly elevates thresholds most noticeably at 4 and 6 kHz (Moore et al. 2022).

When analysing PTA results, interpretations should follow uniform guidelines, detailing the impairment form, specific thresholds per frequency in each ear, or encompassing all key aspects (intensity level, affected bands, category and laterality). Typical indicators include escalating or steady high-register neural deficits (at 3, 4 or 6 kHz, often improving at 8 kHz), a distinct 4 kHz dip, and generally equal involvement on both sides - these hallmarks suggest acoustic influence on the worker's hearing capacity (Department of Occupational Safety and Health 2021).

Auditory impairment is calculated as the mean of lasting threshold values at 500, 1000, 2000 and 3000 Hz, elevated by at least 25 dB above baseline references. Detecting a standard threshold variation (STS) involves an average 10 dB or greater shift at 2, 3 and 4 kHz relative to the

initial audiogram (Department of Occupational Safety and Health 2021).

Clinical History

Establishing an ONRHD diagnosis requires ruling out alternative origins of auditory decline, such as sound exposures occurring beyond the scope of the patient's formal occupational history, including recreational activities such as attending concerts or using personal audio devices at high volumes, domestic exposure to loud machinery or amplified sound systems, prior informal or undocumented employment in noisy environments, that may not have been captured during the official assessment period but could still contribute to cumulative auditory stress.

These scenarios often demand expert input from otorhinolaryngologist, drawing on detailed personal timelines (Moore et al. 2022). Under the 2019 regulations, health checks are mandated for emerging irregular hearing results, with follow-ups the following year only if thresholds show marked changes (Department of Occupational Safety and Health 2021).

In documenting the background of the case, it is essential to detail the nature of acoustic exposures experienced by the individual, including the types, durations, sources and any asymmetry in exposure between the ears. Particular attention should be paid to whether the hearing decline occurred abruptly or followed a progressive trajectory. Additionally, the frequency and pattern of transient hearing reductions or episodes of tinnitus should be noted. If tinnitus is persistent, the severity of tinnitus symptoms can be assessed using standardised grading system such as the tinnitus severity grading, based on how much it affects their daily life proposed by McCombe et al. (2001) or the Tinnitus Functional Index developed by Meikle et al. (2012). The presence of sound sensitivity symptoms, or hyperacusis, should also be explored, including when these symptoms began in relation to exposure periods and their severity. These can be assessed using instruments like the Hyperacusis symptom list (Aazh et al. 2021) or the Hyperacusis Impact Questionnaire (Aazh et al. 2022).

Information regarding the provision and use of hearing protection devices is equally important. This includes the type of protection supplied, the quality of fit, frequency of replacement, consistency of use and any enforcement mechanisms in place. Exposure to ototoxic chemicals, such as industrial solvents, should be documented, along with any history of medications known to affect hearing. These may include chemotherapy agents (Baguley & Prayuenyong 2020), aminoglycosides, non-steroidal anti-inflammatory drugs (NSAIDs), loop diuretics and antimalarials. The presence of current or past medical conditions that may impact auditory health-such as immune or metabolic disorders should be considered, as well as any history of head trauma associated with hearing symptoms. Prior surgical interventions involving the ears or brain should also be noted.

Furthermore, a family history of hearing impairment unrelated to acoustic exposure, such as tumour-related auditory issues, may provide relevant context. Finally, participation in recreational activities involving high sound volumes, such as frequent attendance at music venues, should be recorded, as these may contribute to cumulative auditory stress (Natarajan et al. 2023; Stone et al. 2008).

Physical Examination and Otoscopy Examination

For individuals experiencing auditory deficits, a full head, neck and systemic review is advised, supplemented by ear canal visualisation, which seldom reveals causes of neural-type losses. Most cases yield standard findings during checks, so practitioners must leverage awareness of typical and rare traits tied to various hearing issues.

Initial clinical evaluation often begins with casual monitoring of the individual's interaction during routine conversations, interviews or examinations. This informal observation allows the clinician to assess the person's hearing acuity and comprehension in naturalistic settings, while also identifying any speech irregularities

or cognitive barriers that may warrant further investigation. A thorough head and neck examination follows, focusing on the throat, nasal passages and cervical region, which may reveal signs indicative of chronic or recurrent middle ear pathology. In cases with suspected hereditary components, inspection of the facial features, oral cavity, neck and eyes may provide syndromic clues that support a genetic diagnosis.

Assessment of cranial nerve function is a standard component of the neurological examination, with particular emphasis on cranial nerves III through XII. This is especially relevant when asymmetrical hearing loss is present, as it may point to underlying neurological involvement. Otoscopic examination begins with inspection of the external ear and progresses to internal visualisation of the ear canal and tympanic membrane. This step is critical for identifying physical obstructions such as cerumen impaction or anatomical narrowing, both of which can influence audiometric outcomes.

Although contemporary audiological assessments offer detailed classification of hearing deficits, traditional tuning fork tests remain valuable for cross-verifying electronic results. Simple bedside procedures such as the Weber and Rinne tests, typically performed using a 512 Hz tuning fork, can help differentiate between conductive and sensorineural hearing loss and confirm the reliability of more advanced diagnostic tools.

Requirement for Sufficient Noise Exposure

Factors like sound intensity, pitch, contact duration and noise nature heavily influence the risks of work-related auditory harm. For instance, steady 85 dB exposure [roughly 90 dB(A)] over 8 hours daily, five days weekly for a decade, yields a cumulative level around 100 dB(A), causing an average 17 dB loss at 4 kHz (National Institute on Deafness and Other Communication Disorders 2025; Passchier-Vermeer 1974).

Hazards of occupation-linked NIHL can be lowered by capping levels under 80 dBA (Murphy & Franks 2002). Numerous countries enforce limits to shield staff, with over 80% adopting an 85 dBA threshold and 3 dB adjustment for time-intensity.

Under Section 6 of Malaysia's 2019 Occupational Safety and Health guidelines on noise exposure, employers are required to capping the average daily exposure at no more than 85 dB(A) or ensuring the individual's total noise accumulation-factored for a standard 8-hour workday-does not go beyond 100%. Furthermore, if ongoing acoustic pressure rises above 115 dB(A) during any period or sudden peaks exceed 140 dB(C), steps must be initiated to lessen the chances of developing noise-related auditory damage. These boundaries rely on a 3-dB adjustment mechanism to account for differences in duration and strength of exposure.

CONCLUSION

To effectively mitigate ONIHL, public health interventions must go beyond regulatory compliance and focus on integrated, actionable strategies. These include enforcing engineering controls to reduce noise at the source, mandating routine audiometric surveillance, and strengthening hearing conservation programs with proper fit-testing and worker education. Additionally, empowering occupational health practitioners through targeted training and standardised diagnostic protocols is essential to ensure accurate case identification and reporting. Multi-agency collaboration and culturally tailored outreach, especially for underserved worker populations are critical to sustaining long-term prevention and protecting auditory health across industries.

In summary, auditory impairments linked to workplace noise continue to rank as a primary work-induced ailment across the globe, notwithstanding robust standards governing allowable sound thresholds in job sites. This report provides methods for diagnosing ONRHD, focusing on scenarios mandating formal alerts for occupational disease notification under Malaysian protocols. These details could offer valuable perspectives on the efficacy of earlier

assessment techniques utilised by occupational health experts.

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