

Medicolegal Decision Making in Noise-Induced Hearing Loss–Related Tinnitus

Philippe H. Dejonckere¹ and Jean Lebacqz²

¹ Fund for Occupational Diseases, Brussels, Belgium and Institute of Phoniatics, Utrecht University Medical Center, the Netherlands, and ² Physiological Department, Université Catholique de Louvain, Brussels, Belgium

Abstract: In some patients with occupational noise-induced hearing loss, a significant aspect of the handicap concerns the concomitant tinnitus; thus, this disorder must be considered in evaluating a disability percentage in the insurance context. The main difficulty comes from the lack of objective measures for tinnitus. To reach a maximum of medicolegal objectivity, a system was developed within the Belgian Institute of Occupational Disorders (Brussels) in the form of a four-level decision structure, after exhaustive but noninvasive assessment of patients. An aggregate of multiple-choice responses (affirmative, neutral, negative) to elementary questions leads to a decision of the next level, which in turn determines—together with the other decisions at the same level—the conclusion at a still higher level. A positive outcome on all four level-3 questions is required for recognition of noise-induced hearing loss–related tinnitus as an occupational disorder and for financial compensation (final decision, level 4). We assessed 10 exemplary files on which this system was applied by four experts rating independently. A variant of Cohen's Kappa for multiple raters demonstrated high interrater consistency at the first level. In all cases, the decisions at levels 3 and 4 were identical. In this way, the final medicolegal decision relies on standardized criteria and becomes perfectly transparent.

Key Words: compensation; decision making; forensic medicine; occupational hearing loss; tinnitus

In clinical practice, tinnitus is a fairly common symptom in patients with chronic acoustic trauma and noise-induced hearing loss (NIHL) [1]. In a medicolegal context, tinnitus is mostly a subsidiary item of claim, additional to that for NIHL. However, tinnitus may also be the principal or only complaint (e.g., in patients with a specific and selective noise-induced dip on 4-kHz pure-tone audiometry but without obvious reperfusion on their social hearing). Further, as in some cases tinnitus may cause devastating (and objectionable) effects on one's lifestyle and ability

to work, it may attract levels of compensation higher than those for hearing loss [2].

In such a medicolegal situation (e.g., when a patient claims compensation for an occupational disease), potential financial advantage may be a strong motivation for feigning or exaggeration. The essentially subjective nature of tinnitus renders very difficult—at least in some patients—the choice of equitable medicolegal decisions about the presence and severity of tinnitus. This difficulty implies that assessment must involve a large set of parameters combining subjective and objective items [3].

The method proposed in this article is based on a rational, ranked progression in decision making: At each of four steps, a fairly large number of elementary (cellular) decisions, easily made and reproducible among different experts, leads to a higher decision level (Fig. 1). The four levels are worked through in progression from level 1 to level 4 and consist of 65, 12, 4, and 1 decision, respectively. The ultimate decision is to accept or reject the tinnitus as a true component of the occupational dis-

Reprint requests: Philippe H. Dejonckere, MD, PhD, Institute of Phoniatics, University Medical Center Utrecht, AZU F.02.504, PO Box 85 500, NL-3508 GA Utrecht, the Netherlands. Phone: 31 30 250 7729; Fax: 31 30 252 2627; E-mail: ph.deJonckere@kmb.azu.nl

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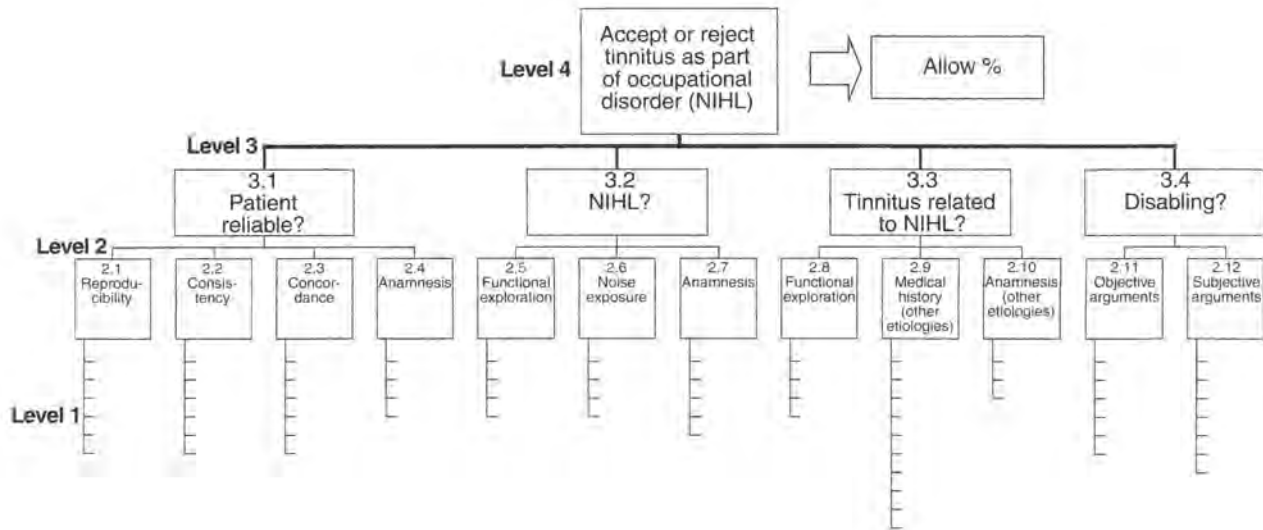


Figure 1. The four progressive levels of decision making (1–4), consisting of 65, 12, 4, and 1 decision, respectively. (NIHL = noise-induced hearing loss.)

order (noise-induced cochlear damage). Directly related to this decision is a determination of the percentage of disability or impairment that may be attributed to this tinnitus component. The main goals are to reach an optimal consistency among experts in these decisions and to offer optimal transparency in case of litigation. The final aim is maximal equity.

However, the proposed system is not intended to be more than a methodological support. Adequate decision making, even at an elementary level, requires exhaustive and encyclopedic knowledge of otoneurology.

PROTOCOL

The four decision levels are structured as follows:

Level 4 (1 decision)

4.1 Final decision: Accept or reject? *Note:* If tinnitus is accepted, the expert must define the percentage of impairment or invalidity.

Level 3 (4 decisions)

- 3.1 Is the patient reliable?
- 3.2 Besides reporting the tinnitus, does the patient also demonstrate an occupational hearing loss?
- 3.3 Is there a link between tinnitus and occupational hearing loss?
- 3.4 Is the tinnitus disabling and, if so, to what extent?

A positive decision about all four of these essential aspects is requested for acknowledging the tinnitus as a part of the occupational disease and for providing compensation.

Level 2 (12 decisions)

As a general rule, possible answers are

- *affirmative:* in agreement, evident, compatible, plausible, concordant;
- *neutral:* dubious, only partially in agreement, unclear, nonevident or irrelevant item, or information lacking; or
- *negative:* not in agreement, incompatible, discordant, unrealistic, unacceptable.

In case of one or more nonaffirmative responses, the expert must judge whether to come to a final positive or negative decision for each question of level 3.

Decisions at Level 2 Pertaining to Decision 3.1 (Is the patient reliable?)

- 2.1 Are measurements based on the patient’s responses reproducible?
- 2.2 Are different approaches of the same physiological phenomenon consistent?
- 2.3 Are subjective data concordant with objective data?
- 2.4 Are the anamnestic data compatible with the (psycho)physiological data?

Decisions at Level 2 Pertaining to Decision 3.2
(Besides reporting the tinnitus, does the patient also demonstrate an occupational hearing loss?)

- 2.5 Does the hearing loss show the characteristics of NIHL at a functional hearing assessment?
- 2.6 Has the patient actually been exposed to harmful occupational noise?
- 2.7 Is the anamnesis and is the history of complaints suggestive of progressive occupational hearing loss?

Decisions at Level 2 Pertaining to Decision 3.3
(Is there a link between tinnitus and occupational hearing loss?)

- 2.8 Does the functional assessment of tinnitus (tinnitometry) suggest the etiology of cochlear noise damage?
- 2.9 Does the medical history demonstrate compatibility of tinnitus with the etiology of cochlear noise damage?
- 2.10 Is the anamnesis and is the history of complaints suggestive of tinnitus related to progressive occupational hearing loss?

Decisions at Level 2 Pertaining to Decision 3.4
(Is the tinnitus disabling and, if so, to what extent?)

- 2.11 Are there convincing objective elements for the nature and severity of impairment, disability, or handicap?
- 2.12 Are there convincing subjective elements for the nature and severity of impairment, disability, or handicap?

Level 1 (65 decisions)

As a general rule as regards level 2, the possible answers are:

- *affirmative*: in agreement, evident, compatible, plausible, concordant;
- *neutral*: dubious, only partially in agreement, unclear, nonevident or irrelevant item, or information lacking; or
- *negative*: not in agreement, incompatible, discordant, unrealistic, unacceptable.

Decisions at Level 1 Pertaining to Decision 2.1
(Are measurements based on the patient's responses reproducible?)

Reproducibility of Psychoacoustic Data

- 1.1 Tone thresholds within one session
- 1.2 Tone thresholds over time
- 1.3 Speech thresholds within one session

- 1.4 Speech thresholds over time
- 1.5 Tinnitus identification within one session
- 1.6 Tinnitus identification over time

Decisions at Level 1 Pertaining to Decision 2.2
(Are different approaches of the same physiological phenomenon consistent?)

- 1.7 Tone-speech audiometry
- 1.8 Recruitment assessment
- 1.9 Conventional thresholds, von Békésy thresholds
- 1.10 Prosthetic tone thresholds
- 1.11 Prosthetic speech intelligibility curves
- 1.12 Masking tests

Decisions at Level 1 Pertaining to Decision 2.3
(Are subjective data concordant with objective data?)

- 1.13 Clinical examination
- 1.14 Impedance measurements, stapedius reflexes
- 1.15 Otoacoustic emissions: spontaneous otoacoustic emissions (SOAE); transient evoked otoacoustic emissions (TEOAE)
- 1.16 Otoacoustic emissions: distortion product otoacoustic emissions (DPOAE)
- 1.17 Brainstem evoked response audiometry (BERA)
- 1.18 Cortical evoked response audiometry (CERA)

Decisions at Level 1 Pertaining to Decision 2.4
(Are the anamnestic data compatible with the [psycho]physiological data?)

- 1.19 Tinnitus mentioned already in medical documents prior to context of claim for compensation
- 1.20 Tinnitus mentioned at medical examination for occupational health and safety
- 1.21 Tinnitus mentioned from the first contact with the Fund of Occupational Diseases
- 1.22 Evidence for therapeutic seeking or therapeutic trials

Decisions at Level 1 Pertaining to Decision 2.5
(Does the hearing loss show the characteristics of NIHL at a functional hearing assessment?)

- 1.23 Type of hearing loss
- 1.24 Severity
- 1.25 Symmetry
- 1.26 Recruitment

Decisions at Level 1 Pertaining to Decision 2.6
(Has the patient actually been exposed to harmful occupational noise?)

- 1.27 Type of exposure
- 1.28 Duration of exposure
- 1.29 Sound pressure levels of exposure
- 1.30 Individual technical protection

Decisions at Level 1 Pertaining to Decision 2.7*(Is the anamnesis and is the history of complaints suggestive of progressive occupational hearing loss?)*

- 1.31 Type of hearing complaints
- 1.32 Time history of complaints
- 1.33 Use of protection devices
- 1.34 Use of hearing aids (at work? in private life?)
- 1.35 Use of masking devices for tinnitus

Decisions at Level 1 Pertaining to Decision 2.8*(Does the functional assessment of tinnitus [tinnitometry] suggest the etiology of cochlear noise damage?)*

- 1.36 Pitch matching
- 1.37 Masking possibility and minimal masking level
- 1.38 Loudness matching
- 1.39 Specific characteristics: pulsatile, bitonal, etc.

Decisions at Level 1 Pertaining to Decision 2.9*(Does the medical history demonstrate compatibility of tinnitus with the etiology of cochlear noise damage?)*

- 1.40 Middle-ear pathology, surgery
- 1.41 Trauma capitis
- 1.42 Acute acoustic trauma
- 1.43 Inner-ear pathology, dizziness, vertigo, fluctuating hearing loss, Ménière's disease, sudden deafness
- 1.44 Nerve VIII pathology, schwannoma
- 1.45 Pharmacology
- 1.46 Poisoning, intoxication
- 1.47 Vascular pathology, hypertension
- 1.48 Neurological pathology, polyneuropathy, central nervous system disease
- 1.49 Psychiatric pathology

Decisions at Level 1 Pertaining to Decision 2.10*(Is the anamnesis and is the history of complaints suggestive of tinnitus related to progressive occupational hearing loss?)*

- 1.50 History of tinnitus (onset)
- 1.51 Relation to working activities, private life activities, etc.
- 1.52 Relief conditions

Decisions at Level 1 Pertaining to Decision 2.11*(Are there convincing objective elements for the nature and severity of impairment, disability, or handicap?)*

- 1.53 Presence or absence of proven therapeutic seeking or demand (medical advice of one or several medical specialists; nonmedical treatments)
- 1.54 Trial of pharmacological treatments
- 1.55 Personal purchase of physical devices (e.g., tinnitus maskers)

- 1.56 Consultation of a neuropsychiatrist
- 1.57 Psychiatric treatment
- 1.58 Psychiatric hospital admission

Decisions at Level 1 Pertaining to Decision 2.12**(Are there convincing subjective elements for the nature and severity of impairment, disability, or handicap?)*

* All of these subjective elements—1.59–1.65—are to be confronted with objective elements—1.53–1.58.

- 1.59 Changes in daily life (ceasing specific activities, hobbies)
- 1.60 Sleeping trouble, use of hypnotic drugs
- 1.61 Avoiding specific eliciting or aggravating circumstances
- 1.62 Behavioral changes: irritability
- 1.63 Neurovegetative symptoms, headache
- 1.64 Influence on mood
- 1.65 Depression, tendency to suicide

MATERIALS AND METHODS**From Subjectivity to Objectivity**

Medicolegal decision making obviously must rely on maximal objectivity. A few basic points may be helpful in assisting medical criticism and experience. Reproducibility requires an internal reference. Inconsistent responses are suspicious. When, within an exhaustive assessment, those topics for which a patient's assertion can be objectively controlled systematically demonstrate reliability, a reasonable assumption is that those for which such an objective control is impossible are also credible.

Reports or indications about existence of tinnitus prior to any compensation claim (e.g., in the file of the occupational medicine physician) support reliability. Similarly, documents proving that the patient has sought relief of tinnitus before making any claim for compensation are highly relevant in this context (repeated medical consultation, acupuncture, purchase of tinnitus maskers, etc.).

Verifiable changes in the daily life or behavior of a tinnitus patient (e.g., terminating one's participation in a choir) may support plausibility and reflect severity as experienced by the patient.

Interrater Reliability

To check for agreement among different experts of first-level decisions and for concordance in higher-level decisions, we selected 10 exemplary files from among the patient material of the Institute of Occupational Disorders. All files were examined by four dif-

ferent medical specialists (otorhinolaryngologists) interested in legal and forensic medicine. Each specialist was required to make his or her decision according to the pathway proposed in this protocol.

A variant of Cohen's Kappa [4] was applied, as this statistical test takes into account the possibility of chance agreement among raters (as no more than three choices are possible). It fits the Kappa to the situation of more than two raters. The test reveals a Kappa value of 0.74, demonstrating a high interrater consistency at the first level. In all 10 cases, the decisions at levels 3 and 4 were identical.

CONCLUSION

Tinnitus is frequently associated with occupational hearing loss and can be an additional item of claim in countries applying a specific insurance system for occupational disorders. However, tinnitus generally cannot be objectified. A decision-making system based on an exhaustive assessment and a four-level decision structure proves to be helpful. An aggregate of multiple-choice decisions (affirmative, neutral, negative) on ele-

mentary questions leads to a decision at the next level, which in turn determines—together with the other decisions at the same level—the conclusion at a still higher level. A variant of Cohen's Kappa for multiple raters demonstrated high interrater consistency at the first level (10 cases, 4 raters). In all cases, the decisions at higher levels 3 and 4 appear to be identical. In this way, the final medicolegal decision relies on standardized criteria and becomes perfectly transparent in cases of litigation.

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