ELSEVIER

Risk Factors and Impacts of Incident Tinnitus in Older Adults

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PURPOSE: We used a representative older population-based cohort to establish the predictors and impacts of tinnitus.
METHODS: A total of 1,214 participants of the Blue Mountains Hearing Study were followed for 5 years (1997 – 1999 to 2002 – 2004). The presence of tinnitus was assessed by an audiologist-administered questionnaire. Hearing impairment was defined as the pure tone average $(PTA)_{0.5–4KHz} > 25$ dB HL, in the better ear. Quality of life was measured by use of the Short Form 36-item Health Survey (SF-36). Depression was assessed using either the SF-36 (Mental Health Index, subscale) and the Center for Epidemiologic Studies Depression Scale.
RESULTS: Symptomatic dizziness and hearing loss were significant risk factors for incident tinnitus, multivariable-adjusted odds ratio, 2.41 (95% confidence interval, 1.62–3.58) and odds ratio 2.31 (95% confidence interval, 1.46–3.66), respectively. Incident tinnitus cases demonstrated significantly lower mean SF-36 scores compared with subjects without tinnitus and were more likely to be depressed as assessed by both the Mental Health Index and Center for Epidemiologic Studies Depression Scale.
CONCLUSIONS: Incident tinnitus was predicted by two otological risk factors, dizziness and hearing loss. Temporal data documented diminished quality of life and psychological well-being in those subjects experiencing tinnitus. This finding highlights the importance of effective intervention strategies to prevent potentially debilitating morbidity associated with tinnitus.
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KEY WORDS: Blue Mountains Eye Study, Blue Mountains Hearing Study, Depressive Symptoms, Dizziness, Hearing Loss, Neck Injury, Quality of Life, Tinnitus.

INTRODUCTION

Chronic tinnitus affects between 15% and 30% of the adult population, including around 1% to 5% who are severely affected (1,2). Many tinnitus patients describe the symptoms as transient "ear noises," in association with sudden temporary hearing loss (3). The authors of very few population-based studies have longitudinally assessed the risk factors for this frequent and often debilitating condition (4–6). One of the few older population-based cohort studies to have examined the incidence of tinnitus is the Epidemiology of Hearing Loss Study (EHLS) (7), which included 3,753 participants at baseline ages 48 – 92 years. The authors identified potential risk factors associated with the 5-year incidence of tinnitus, including hearing loss, history of head injury, greater total serum cholesterol, and a history of otosclerosis (7).

Some tinnitus patients do not seem to be bothered by the sound and get accustomed to it. Others report that they are distressed by their tinnitus and that it causes debilitating problems (8). Morbidities reported to be associated with debilitating tinnitus include depression, anxiety, frustration, insomnia, and suicide (4 – 6). Additionally, tinnitus is also associated with reduced cognitive function (9,10). The EHLS demonstrated that tinnitus impacts on the quality of life (11). Adjusted mean 36-Item-Short-Form Health Survey (SF-36) scores were lower for those who first reported tinnitus at the follow-up (5-year incidence of tinnitus) compared with those who reported tinnitus at both the baseline and follow-up examinations (prevalent tinnitus) (11).

The majority of epidemiological studies on tinnitus have been conducted in specific population groups such as patients attending audiology or tinnitus clinics or noise-exposed workers (12,13). In this report, however, we aimed to delineate the risk factors for incident tinnitus in a population-based cohort. We also aimed to document the effects of tinnitus on cognitive function, mental health, and quality of

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Selected Abbreviations and Acronyms

EHLS = Epidemiology of Hearing Loss Study
SF-36 = 36-Item-Short-Form Health Survey
BMHS = The Blue Mountains Hearing Study
BMES = Blue Mountains Eye Study
PTA = pure-tone average
MHI = Mental Health Index
CES-D-10 = Center for Epidemiologic Studies Short Depression Scale
OR = odds ratio
CI = confidence interval
PAR = population-attributable risk

life. These data are potentially important to develop health policy and to plan and implement tinnitus-related health care services.

METHODS

Study Population

The Blue Mountains Hearing Study (BMHS) is a population based-survey of age-related hearing loss in an older Australian community, among participants of the Blue Mountains Eye Study (BMES) cohort. During 1992 – 1994, BMES researchers initially assessed 3654 persons age 49 years or older residing in two postcode areas west of Sydney, Australia (14). Surviving baseline participants were invited to attend 5-year follow-up examinations (1997 – 199, BMES-2) and at 10 years (2002 – 2004, BMES-3), at which 2334 (75.1% of survivors) and 1952 participants (75.6% of survivors) were re-examined, respectively. Hearing was measured at BMES-2 and BMES-3; hence, the 5-year incidence of tinnitus was assessed by the use of data collected at these two studies.

Audiological Examination: Hearing and Tinnitus-Related Questions

History of prolonged tinnitus was included in a comprehensive questionnaire about hearing administered by a university-trained audiologist. The presence of tinnitus was estimated by the use of a single question from this hearing questionnaire: "Have you experienced any prolonged ringing, buzzing, or other sounds in your ears or head within the past year…that is lasting for five minutes or longer?" Possible responses would include, "yes," "no," or "missing response." All missing responses were excluded from analysis. Those responding to this question were classified into those with or without tinnitus. Subjects reporting tinnitus were then asked further questions such as "How annoying is your tinnitus?" and given the following choices: (i) extremely annoying; (ii) very annoying; (iii) mildly annoying; or (iv) not annoying at all. They were also asked about whether they sought treatment for their tinnitus (e.g., hearing aid, medications, tinnitus masking) and which of those treatments (if any), they had found the most helpful. Finally, they were asked whether they sought help or have spoken to a professional about their tinnitus and which professional(s) they contacted.

The audiologist asked additional questions, including history of any self-perceived hearing problem, including its severity, onset, and duration; whether primary care practitioners or other professionals had been consulted; and whether a hearing aid had been provided. Hearing-related questions also included family history of hearing loss, past medical or surgical treatment of otologic conditions, diseases associated with hearing loss, and risk factors for ear disease. Other questions addressed exposure to noise at work, or during military service or leisure activities and past use of ototoxic drugs.

The severity of noise exposure was subjectively classified in three ways: mostly quiet, tolerable level, or unable to hear speech. Hearing function was assessed by pure-tone audiometry at each visit performed by audiologists in sound-treated booths by the use of TDH-39 earphones and Madsen OB822 audiometers (Madsen Electronics, Taastrup, Denmark). Hearing impairment was determined as the pure-tone average of audiometric hearing thresholds at 500, 1000, 2000, and 4000 Hz ($PTA_{0.5–4kHz}$), defined mild hearing loss as $PTA_{0.5–4kHz} > 25$ to ≤ 40 dB HL; moderate hearing loss as $PTA_{0.5–4kHz} > 40$ to ≤ 60 dB HL; and severe hearing loss as $PTA_{0.5–4kHz} > 60$ dB HL) in the better ear. This defined hearing loss as bilateral. Audiologists also screened participants for reported dizziness with the question, "Have you ever experienced any dizziness or unsteadiness in the past year?"

Assessment of Risk Factors

The medical history of participants was taken and included cardiovascular disease and risk factors, medications used, exercise, smoking, and caffeine or alcohol consumption. We also assessed the number of baseline BMHS-1 participants who had been diagnosed as having grade 2 or greater (severe) hypertension (according to World Health Organization/ International Society of Hypertension guidelines) (15), i.e., those who had previously diagnosed hypertension and were using antihypertensive medications or had a systolic blood pressure ≥ 160 mm Hg or diastolic blood pressure ≥ 100 mm Hg at baseline examination. Participants also returned for fasting blood glucose and other tests, including total cholesterol and high-density lipoprotein cholesterol (16).

Assessment of Impacts

The SF-36 is the most widely used generic quality of life assessment (17). The instrument contains 36 items,