



“Ringing in the Ears”: Narrative Review of Tinnitus and Its Impact

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Abstract

About 10% of the population experiences tinnitus, a common and distressing symptom characterized by the perception of sound in the absence of external stimuli. There is, however, marked heterogeneity in etiology, perception, and extent of distress among those who experience tinnitus. Reactions to tinnitus vary from simple awareness to severe irritation; some people have difficulty in hearing because of the loudness of the noise. Severe tinnitus causes many, often psychological, symptoms (e.g., tension, frustration, impaired concentration, disrupted sleep). For some, tinnitus is temporary, for others it is longstanding. Although many people adjust successfully, others are disabled by tinnitus; approximately 5% experience persistent and severe symptoms affecting their lifestyle and significantly reducing their quality of life. Because tinnitus is poorly understood and no single therapeutic approach is effective for all patients, many patients are told that “nothing can be done” and they must “learn to live with it.” In spite of these challenges, there is remarkably little relevant nursing literature on tinnitus. This literature review was conducted to explore current knowledge of tinnitus, including prevalence, causes and diagnosis, and assessment. Its psychosocial effects and impact on individuals are considered. Implications for practice are discussed—demonstrating that understanding the full impact of the condition and identifying patients’ needs are essential to effective care.

Keywords

tinnitus, hyperacusis, cognitive behavioral therapy, tinnitus-retraining therapy, literature review

Tinnitus refers to a perception of noise arising without corresponding auditory stimulation (Baguley, 2002). This poorly understood condition is experienced by 10%–15% of the population at some time during their lifetime (Andersson, Baguley, McKenna, & McFerran, 2005; Davis & El Refaie, 2000). For some it is temporary, arising, for example, after exposure to loud noise (Royal National Institute for Deaf People [RNID], 2009); for others, longstanding tinnitus resists medical or surgical treatment. Although often described as “ringing in the ears,” patients also refer to whistling, hissing, buzzing or roaring of varying intensity, loudness, and pitch. These sounds may be simple (e.g., whistling) or complex (e.g., music; McKenna, 2008); patients may hear single or multiple sounds (Baldo, Doree, Lazzarini, Molin, & McFerran, 2008). Although some patients describe their tinnitus as music or distant voices, they cannot discern what music is playing or what voices are saying. Other symptoms of psychosis are not usually evident, thus distinguishing the condition from the musical hallucinations associated with psychiatric conditions such as schizophrenia (McKenna, 2008). Approximately 40% of those with tinnitus also develop hyperacusis, or intolerance to environmental sounds (Baguley, 2003), which may lead to misophonia—an intolerance to specific sounds (Møller, 2006) or an emotional response to sounds (Henry, Dennis,

& Schechter, 2005), thus exacerbating the difficulties they face (Jastreboff & Jastreboff, 2006).

Patients may find tinnitus a trivial complaint; alternatively, it may be a debilitating condition. Severe tinnitus, with or without hyperacusis, is extremely disturbing because it impairs concentration and hearing (Heller, 2003) and disrupts everyday activities and sleep (Davis & El Refaie, 2000; RNID, 2010). Those with severe tinnitus report intrusiveness and irritation (McKenna & Andersson, 1998); rarely, intractable tinnitus leads to suicide (Jastreboff, Gray, & Gold, 1996).

Despite the serious impact on quality of life and lack of a definitive treatment for tinnitus, there is remarkably little relevant information about it in the nursing literature. In the following review, we address that deficit and offer guidance for

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patient care by providing an overview of tinnitus and its management and discussing the impact of the condition on sufferers.

Method

This review covers literature from the period 1980–2009. We searched the following databases using the keyword “tinnitus”: CINAHL, British Nursing Index, Scencedirect, Swetswise, EBSCO, Medline, Cochrane Library, and Google Scholar. This search unearthed a large volume of diverse material but little from the nursing literature. We included papers and texts published in English and meeting the aims of the review. We expanded the data available through scrutiny of the reference lists of the retrieved articles and inclusion of gray literature.

Findings

Manifestations and Causes of Tinnitus

Manifestations of tinnitus. As a symptom rather than a disease, tinnitus is classified in various ways. It may be acute, lasting days or weeks, or chronic, lasting for >6 months (Folmer, Martin, & Shi, 2004). Classification may be based on its etiology, as sources within (cochlear) or external to (extracochlear) the auditory system, or described as subjective or objective. This distinction is important in terms of care and treatment. Subjective tinnitus, the more common of the two, is sometimes referred to as a “phantom” sensation, as the sound, heard only by the sufferer, is experienced in the absence of external stimuli (Jastreboff, 1990). Subjective tinnitus occurs at different levels of severity. It may arise in conjunction with hearing loss but often no cause is found. In contrast, objective tinnitus, which accounts for fewer than 1% of cases (Folmer et al., 2004), is created by an acoustical source within the body and can be heard by those close to the patient’s ear (Lockwood, Salvi, & Burkard, 2002). It can arise in cases of, for example, temporomandibular joint and vascular abnormalities (Folmer et al., 2004), abnormal functioning of the central auditory system, or muscular disorders (e.g., palatal myoclonus, stapedius tendon spasm, patulous eustachian tube; Møller, 2003).

Patients may perceive tinnitus as originating in the head (tinnitus cerebri) or the ear (tinnitus aurium; Weissman & Hirsch, 2000). It may be unilateral or bilateral, pulsatile or nonpulsatile. Pulsatile tinnitus coincides with the heartbeat, suggesting a vascular source; whereas the more common nonpulsatile tinnitus is continuous and constant. Both unilateral and pulsatile tinnitus require further investigation.

Causes of tinnitus. Although many theories have been used to explain the occurrence of tinnitus, its pathophysiology is poorly understood and a single underlying pathological process is unlikely (Baguley, 2002; Baldo et al., 2008). Although most cases are related to aging, hearing loss, or noise exposure, almost any disorder involving the outer, middle, or inner ear or auditory nerve may cause tinnitus (Andersson, 2002).

Approximately 75% of those aged 18–30 years regularly attending nightclubs or concerts experience temporary tinnitus (RNID, 2009), and tinnitus is the most common injury among those returning from areas of conflict (e.g., Afghanistan, Iraq [American Tinnitus Association, 2010a]). Tinnitus can, however, arise in the absence of any aural pathology (Baldo et al., 2008).

Acute tinnitus may be caused by infection, medication, head or neck injury, excessive noise exposure, earwax, or changes in blood pressure or metabolism (Folmer et al., 2004). Chronic tinnitus may also result from such conditions, though it is more commonly associated with disorders causing conductive or sensorineural hearing loss (Crummer & Hassan, 2004). Conductive hearing loss arises from abnormalities of the middle or external ear that reduce the ability to conduct sound, such as tympanic membrane defects, middle ear effusions, cerumen in the external auditory canal, infection, cholesteatoma or ossicular abnormalities, for example, fixation (including otosclerosis), and discontinuity or erosion. Sensorineural hearing loss may arise from damage to any part of the inner ear or neural pathways to the brain, vestibulocochlear nerve dysfunction, genetic causes, systemic disease, or ototoxic substances (Bagai et al., 2006).

Tinnitus may also be associated with Ménière’s disease or acoustic neuroma (vestibular schwannoma; Jastreboff et al., 1996). It can be caused by ototoxic medications including antibiotics, particularly aminoglycosides; chemotherapy (e.g., cisplatin), nonsteroidal anti-inflammatory drugs; diuretics; and antimalarial drugs. Indeed, more than 130 drugs are ototoxic (Yorgason, Fayad, & Kalinec, 2006). Medications most likely to cause tinnitus, which may be an early indicator of toxicity, are shown in Table 1. Ototoxicity, which may be temporary or permanent, may also cause reversible hearing loss and, more rarely, vertigo (Crummer & Hassan, 2004). Metabolic disorders, such as hypo- or hyperthyroidism, lipidemias, anemia (Kazmierczak & Doroszewska, 2001), or hyperinsulinemia (Kraft, 1998), and more rarely, neurological disorders, (e.g., head injuries, whiplash, multiple sclerosis; Folmer & Griest, 2003) or temporomandibular dysfunction (Folmer & Griest, 2000) can also cause tinnitus.

Tinnitus may also be associated with damage to the auditory nerve due, for example, to microvascular compression syndrome, viral infections, tumors affecting the nerve or auditory nerve tumors (Hain, 2010). Alternatively, tinnitus may be a complication of skull base surgery, such as microvascular decompression for trigeminal neuralgia or hemifacial spasm (Goto et al., 2002). Rarely, tinnitus can be an ictal phenomenon when both musical and verbal hallucinations have been reported (Rennie, 1964). For example, Hurst and Lee (1986) reported that unilateral high-pitched tinnitus was the only manifestation of epilepsy in a 45-year-old woman.

Frequency of Tinnitus

Although epidemiological data show that the incidence of tinnitus is variable, it undoubtedly affects a significant number

Table 1. Examples of Medications Causing Tinnitus

Type of Medication	Examples	Tinnitus-Related Effects
Analgesics	Salicylates, nonsteroidal anti-inflammatory agents	Cause subjective and high-frequency tinnitus; may be reversible when the drug is stopped
Antibiotics	Aminoglycosides, e.g., gentamicin, streptomycin, neomycin. Other antibiotics such as erythromycin, azithromycin, vancomycin, tetracycline, and chloramphenicol.	Cause subjective and high-frequency tinnitus; not usually reversible
Antineoplastic agents	Bleomycin, cisplatin, methotrexate, vincristine	Cause subjective and high-frequency tinnitus; not usually reversible
Loop diuretics	Bumetanide, ethacrynic acid, and furosemide	Cause subjective and high-frequency tinnitus; usually reversible when the drug is stopped
Others		
Quinine/chloroquine		Cause subjective and high-frequency tinnitus; transient and usually reversible
Tricyclic antidepressants	Amitriptyline, imipramine, doxepin	Cause subjective and high-frequency tinnitus; usually reversible when the drug is stopped

of people. For example, about 4.7 million people experience tinnitus in the United Kingdom (RNID & British Tinnitus Association [BTA], 2006). Approximately 5% of those affected report persistent, severe tinnitus affecting their lifestyle (Scott & Lindberg, 2000); 0.5%–3% report a significant impact on quality of life (Andersson et al., 2005). The American Tinnitus Association (ATA; 2010b) estimates that over 50 million Americans experience some degree of tinnitus. Of these, 12 million seek professional help and 2 million are “debilitated” by tinnitus. Similar numbers are affected in Japan, Europe, and Australia (Pray & Pray, 2005; Sindhusake et al., 2003). In Germany, 1.5 million adults report “considerably annoying” tinnitus, with 4% finding it distressing and approximately 2% suffering from considerable impairment (Pilgramm et al., 1999). In Italy, 14.5% of adults experience prolonged spontaneous tinnitus (Quaranta, Assennato, & Sallustio, 1996).

Approximately 33% of children report occasional tinnitus, with 10% of these finding it “bothersome” (Baguley & McFerran, 2002). Tinnitus is, however, more common in adults, and the incidence of tinnitus increases with age (Davis & El Refaie 2000). A third of sufferers are over 55 years of age (Lockwood et al., 1998). Only 1% of people under 45 years of age experience tinnitus, whereas 12% of those 60–69 years of age (Davis & El Refaie, 2000; Heller, 2003) and 25%–30% of those over 70 years of age experience it (Sanchez, 2004). Of 674 people aged over 70 years, Rosenhall and Karlsson (1995) found that 8%–15% experienced continuous tinnitus and 20% occasional tinnitus. The distress associated with tinnitus also increases with age (Davis & El Refaie, 2000). Older people, particularly women, find it especially annoying (Andersson et al., 2005). Evidence also suggests that women experience more complex tinnitus (Dineen, Doyle, & Bench, 1997), though why tinnitus is experienced differently between the genders is unclear (Andersson, 2002; McKenna, 2008). Prevalence is also about three times higher in those with impaired hearing than in those with normal hearing, though the gap narrows after the age of 75 years (Tyler, 2000). Thus, 85% of tinnitus patients also have hearing loss, whereas 35% have moderate-to-severe auditory impairment (Weinstein, 2000).

In 2005, more than 13 million people in the United States and Western Europe sought medical advice for tinnitus (Vio & Holme, 2005). Since spontaneous improvement is unlikely, particularly when tinnitus is chronic (Rief, Weise, Kley, & Martin, 2005), nurses are likely to encounter affected patients in their daily practice, thus having many opportunities to offer reassurance, information, and support (Appelqvist et al., 2001).

How Tinnitus is Diagnosed?

Because tinnitus is subjective and there are no objective tests to verify its presence, diagnosis is largely based on the patient’s report of symptoms (El Refaie et al., 2004). Thorough investigation by an otologist may be recommended to exclude potentially life-threatening or treatable neurological disease and to help to direct treatment strategies. As comorbid conditions may be contributory factors in cases of tinnitus, the health care practitioner gathers information about the patient’s general health (Lockwood et al., 2002). Patients’ descriptions of their conditions and the sounds they hear are important and help to distinguish subjective from objective and pulsatile from nonpulsatile tinnitus. Such information, combined with a review of medications the patient is taking (both prescribed and over-the-counter), may indicate the cause of the tinnitus. The health care practitioner may order laboratory and other tests (e.g., imaging), depending, as in other medical conditions, on the patient’s history and the findings on physical examination.

Evaluation of the external auditory canal, integrity of the tympanic membrane, and cranial nerve function may provide evidence of hearing loss or brain stem impairment. Periauricular auscultation and palpation are helpful in identifying objective tinnitus (Crummer & Hassan, 2004; Folmer et al., 2004). Subjective tinnitus, however, cannot, by definition, be detected by anyone other than the patient (Baldo et al., 2008). Tympanometry may identify undetected middle ear effusions, changes in tympanic membrane stiffness caused by a patulous eustachian tube or myoclonus of palatal or stapedial muscle (Lockwood et al., 2002).

As most tinnitus patients have some degree of hearing impairment, a comprehensive audiologic evaluation is essential as part of the diagnostic process (Lockwood et al., 2002), including evaluation of the function of the cochlear portion of vestibulocochlear nerve; hearing tests, including pure tone, air, and bone conduction thresholds and speech discrimination; and auditory brain stem response to evaluate retrocochlear activity and otoacoustic emissions (Pratt, 2003). This evaluation can be useful in determining the cause of the tinnitus, as the symptom may be due to abnormal spontaneous activity in the auditory system and related cerebral areas reflecting dysfunction in the brain stem or auditory cortex (Lockwood et al., 1998).

Such changes can be visualized by imaging. For example, Lockwood and colleagues (1998) used positron emission tomography (PET) to reveal cerebral blood flow, showing that pure tones presented to subjects with tinnitus activate more portions of the brain than the same tones presented to those without tinnitus, suggesting that central auditory mechanisms are involved in tinnitus perception. Similarly, Gardner and colleagues (2002) used single photon emission computed tomography (CT), and Melcher, Sigalosky, Guinan, & Levine (2000) used functional magnetic resonance imaging (MRI) to find that tinnitus affects central mechanisms associated with both hearing and sound processing and emotion and attention (e.g., amygdala; Mirz, Mortensen, Gjedde, & Pedersen, 2002). Subjective reports and recent research support this finding, as tinnitus patients show heightened heart rates and increased muscle tension when listening to their tinnitus or a tinnitus-like sound (Rief et al., 2005). Such approaches are increasingly used in diagnosing the cause of tinnitus.

Radiological and imaging investigations can be useful in both finding treatable causes of (Madani & Connor, 2009) and diagnosing tinnitus. For example, contrast-enhanced CT or MRI can help in diagnosing vascular abnormalities causing pulsatile tinnitus, whereas in patients with nonpulsatile (continuous) tinnitus, gadolinium-enhanced MRI is the method of choice (Weissman & Hirsch, 2000).

Because tinnitus is primarily a subjective symptom, there is no consensus about how best to determine the handicap it causes (Davis & Morgan, 2008). As tinnitus severity exists along a continuum, the symptom may not be evident to a patient when she or he is surrounded by normal daily sounds; awareness increases, however, in quiet environments and at night (Møller, 2003; RNID, 2007). Attempts have been made to define and quantify the severity of tinnitus by evaluating how much and how often tinnitus detracts from enjoyment of life, the extent and frequency of "bothersome" tinnitus or how disabling patients find it (Folmer et al., 2004). Indirect measures, such as the Tinnitus Handicap Questionnaire (Kuk et al., 1990), the Tinnitus Severity Index (Meikle, Griest, Stewart, & Press, 1995), and the Tinnitus Reaction Questionnaire (Wilson et al., 1991), have been used to quantify its impact and severity. Such measures have been criticized, however, for including only some of the relevant aspects of tinnitus severity (Andersson et al., 2005). El Refaie and colleagues (2004) instead

use a simple measure of level of annoyance to measure severity of tinnitus and report that 53% of patients complain of severe annoyance.

Although it is difficult to describe the quality and loudness of the sound a patient perceives with tinnitus, researchers have attempted to measure these variables by matching the tinnitus to the known loudness of a pure tone presented to the contralateral ear (Tyler & Conrad-Arnes, 1983). However, since the sounds perceived in tinnitus may be more complex than a pure tone (Andersson et al., 2005), even an "exact" match may fail to reflect the severity of the effect on a patient's life (Benson et al., 2006). Loudness measurements are, however, useful when attempting to mask tinnitus using external sound and will also demonstrate to patients that the health care provider understands the level of their symptoms.

Impact of the Characteristics and Severity of Tinnitus on Individuals

Although about 80% of those with tinnitus adapt to the condition, approximately 20% experience clinically significant negative effects (Davis & El Refaie, 2000; Jastreboff & Hazell, 1993), not all of which can be attributed to otologic factors (Henry & Meikle, 2000). Although those with hearing loss experience greater subjective discomfort associated with tinnitus, the factors predisposing patients to tinnitus-related distress are not entirely clear. Adjustment to tinnitus is not directly related to its severity (Delb, D'Amelio, Schonecke, & Iro., 1999), perhaps reflecting psychological processing rather than the audiologic characteristics of the condition (Henry & Wilson, 2000). In fact, many of the effects of tinnitus are psychological rather than physical, including tension, frustration, anger, depression, loss of concentration, sleep disturbance (Andersson et al., 2005; Lockwood et al., 2002), and constant anxiety; such factors draw further attention to tinnitus and tend to increase its impact, creating a vicious cycle (Appelqvist et al., 2001). Indeed, tinnitus is associated with considerable psychological morbidity. Mood disorders and tinnitus arise concurrently in nearly 21% of tinnitus patients (Andersson et al., 2005). McKenna, Hallam, and Hinchcliffe (1991) demonstrated that 45% of neuro-otology patients with tinnitus showed signs of psychological disturbance, whereas Harrop-Griffiths, Katon, Dobie, Sakai, and Russo (1987) found a lifetime prevalence of major depression in 62% and current depression in 48% of patients with tinnitus. Zöger, Holgers, and Svedlund (2001) similarly found that 62% of tinnitus patients displayed signs of depression sometime during the course of their tinnitus, 39% experienced ongoing depression, and 45% had an anxiety disorder. Although levels of depression are higher in those with tinnitus than in the general population, the subjective annoyance associated with tinnitus may, itself, cause depression (Andersson & McKenna, 1998). In the study of Zöger and colleagues, tinnitus preceded mood disorders in 23.5% of patients. As patients with tinnitus who are also depressed rate the severity of their tinnitus significantly higher than those who are not depressed, tinnitus may be reduced or alleviated by antidepressant therapy (Folmer, 2002; Folmer & Shi, 2004).

Stress and fatigue appear to exacerbate tinnitus severity (Hébert & Lupien, 2007). Conversely, some believe that tinnitus is, itself, a chronic stressor (Scott, Lindberg, Melin, & Lyttkens, 1990). Hébert and Lupien (2009) observed a blunted and delayed cortisol response to psychosocial stress in tinnitus patients compared to controls, yet this was not associated with increased subjective tinnitus intensity. Although stress may not provide sufficient stimulus to increase the intensity of tinnitus, it may reduce a patient's ability to cope with the symptom (Andersson et al., 2005). Indeed, evidence indicates that patients with sudden hearing loss and tinnitus experience more stressful events and daily hassles and display fewer coping abilities than other clinical groups (Schmitt, Patak, & Kröner-Herwig, 2000). Moreover, Holgers, Zöger, and Svedlund (2005) found that anxiety disorders and poor well-being could predict the severity of tinnitus, whereas Weber, Arck, Mazurek, and Klapp (2002) found that relaxation therapy reduced stress-related immunological parameters in tinnitus patients.

Disrupted sleep is one of the most significant complaints among tinnitus patients (Megwalu, Finnell, & Piccirillo, 2006), affecting between 25% (Sanchez & Stephens, 1997) and 70% (Andersson et al., 2005) of people with the condition. Patients experiencing disrupted sleep complain of more complex and distressing tinnitus sounds (Folmer & Griest, 2000), perhaps reflecting anxiety about lack of sleep, which focuses attention on the tinnitus. Approximately 80% of children with tinnitus report sleeping difficulties (Kentish, Crocker, & McKenna, 2000).

Complaints of the distracting effects of tinnitus are common. Many patients report that its intrusiveness leads to poor attention and concentration (Heller, 2003; Sanchez & Stephens, 1997). Such complaints are supported by performance test outcomes (Rossiter, Stevens, & Walker, 2006), though early studies comparing cognitive function in those with tinnitus and those with hearing loss but no tinnitus suggested that, whereas tinnitus sufferers experienced more difficulties, there was little objective evidence of poorer performance (Broadbent, Fitzgerald, & Parkes, 1982; McKenna, Hallam, & Shurlock, 1996). Later work, however, comparing tinnitus patients with hearing-impaired individuals and those with normal hearing showed that tinnitus patients performed less effectively than those in either of the other groups and tinnitus reduced reaction time in performing visual tasks (Andersson, Eriksson, Lundh, & Lyttkens, 2000; Stevens, Walker, Boyer, & Gallagher, 2007). These differences in performance could not be accounted for by differences in hearing or levels of anxiety or depression and perhaps reflected difficulty on the part of the tinnitus patients in controlling attention (Stevens et al., 2007). Similarly, 42% of the respondents in a survey by the RNID and BTA (2006) reported that tinnitus interfered with their working lives, with many confessing that they concealed their tinnitus for fear that colleagues "wouldn't understand." Additionally, 23% believed that it might affect their job prospects.

Hyperacusis exacerbates these difficulties. Affecting about 40% of tinnitus patients (Jastreboff & Jastreboff, 2006), this

decreased threshold for sound renders everyday sounds intrusively loud, uncomfortable, or painful (Baguley & McFerran, 2007). However, not all sounds cause equal distress. Why individuals are more disturbed by some sounds than others, even though they are louder, is unclear but may reflect an intrinsic feature of the sound rather than volume. Electrical and machine noises are among those least tolerated (Deafness Research UK [DRUK], 2010). Whatever its cause, the associated anxiety impairs concentration and causes tension or anger; some are so afraid of noise that they withdraw from social and professional activities (Baguley, 2003).

Such effects may exacerbate the social impairment that so often accompanies tinnitus. However, it is not known whether this is a direct result of tinnitus or an indirect expression of preexisting psychological vulnerability. Animal studies suggest that tinnitus triggers complex behavioral modifications that are expressed at both the individual and the social level (Guillon, 2009), implying that tinnitus may be a direct cause of psychosocial impairment. Not surprisingly, 41% of patients report negative effects on personal relationships. Similarly, 78% of patients believe this effect occurs because they are more stressed. Some perceive punitive family responses (Granqvist et al., 2001), and others state that lack of understanding from a partner has significantly influenced their overall well-being (RNID & BTA, 2006). Despite these findings, the impact of tinnitus on families has been little researched (Andersson et al., 2005).

Clearly, tinnitus can be associated with marked psychological distress and severe effects on daily function (Davis & El Refaie, 2000; Heller, 2003). These effects, in turn, reduce the quality of life. Although there are stronger associations between psychological and demographic factors and suicidal tendencies, tinnitus is occasionally so incapacitating that those affected consider suicide (Jastreboff et al., 1996; Simpson & Davies, 1999). Lewis, Stephens, and McKenna (1994) reported that 40% of their tinnitus patients had killed themselves within 2 years, but most of these cases were associated with comorbid psychiatric disturbances. Johnston and Walker (1996) found that socially isolated, older males were the most vulnerable.

Møller (2000) has compared living with tinnitus to living with chronic pain. Although both can be intractable and difficult to treat and may significantly affect the quality of life, their impact on patients may not be recognized or acknowledged and patients may be denied adequate social support (Lonardi, 2007). Often, even health care providers overlook the effects of these chronic conditions, and individuals are left to cope with them alone.

Adapting to any chronic health condition inevitably necessitates changes to lifestyle, aspirations, and goals, which may undermine identity, self-reliance, and social relationships (Davis & Morgan, 2008). Tinnitus may, thus, change the way individuals perceive their lives and themselves and believe others see them. Taken together, these factors may influence the way individuals make sense of illness, causing them to search for explanation and meaning.

Davis and Morgan (2008) have studied the way individuals interpret the meaning of tinnitus and its impact on acceptance

and personal growth, finding that its severity and impact vary among individuals. For some, its impact is devastating, robbing them of peace of mind, a career, and a way of life, leading them to ask, "Why me?" Although those finding explanations were more likely to report positive life changes, they did not experience fewer depressive symptoms or greater well-being than those who were unsuccessful. Others, who did not search for meaning, appeared to adopt an attitude of acceptance and accommodation and reported a greater sense of well-being, perhaps because their tinnitus was of gradual onset and longer duration so that adaptation and acceptance occurred over time. Patients may experience a greater perception of "threat" when the onset is acute. Negative responses from health professionals may exacerbate this perception, leading to emotional distress.

Individuals often respond to the uncertainty associated with illness by attempting to access medical knowledge (Richardson et al., 2006). For those with tinnitus, who are often misdiagnosed and frustrated that health professionals, particularly family doctors, appear not to understand or appreciate their condition, this endeavor can be difficult (Davis & Morgan, 2008; RNID, 2007). The meaning these patients attach to tinnitus may, therefore, be as disabling as its symptoms.

The Treatment and Management of Tinnitus

The complex and diverse etiology, and number of potential underlying causes, makes treating tinnitus a significant challenge (Baguley, 2007). As there is currently no generally effective treatment, care is primarily directed toward management and amelioration of the condition's deleterious effects. Some patients obtain relief from "simple" aural irrigation to remove impacted cerumen. Medication or surgery may be effective for others. For example, some patients with otosclerosis may benefit from stapedectomy (Ayache, Earally, & Elbaz, 2003), whereas myringotomy is the preferred treatment for chronic otitis media and eustachian tube dysfunction (Thrasher & Allen, 2005). Tinnitus of ictal origin can be treated with antiepileptic medication (Hurst & Lee, 1986).

However, when tinnitus is chronic, the goals become enhancing patients' understanding, encouraging them to pay less attention to tinnitus and gaining control over it (Folmer, 2002). Thus, many treatments involve psychological and/or educational components. The most common are cognitive behavioral therapy (Londero et al., 2004) and tinnitus retraining therapy (TRT; Jastreboff & Hazell, 1993), both of which can reduce distress (Zachriat & Kröner-Herwig, 2004), enhance coping, help patients manage their tinnitus more effectively, and improve quality of life (Kröner-Herwig, Frenzel, Fritsche, Schilkowsky, & Esser, 2003; Martinez Devesa, Waddell, Perera, & Theodoulou, 2008).

Cognitive behavioral therapy (CBT) addresses psychological mechanisms (e.g., dysfunctional appraisal, selective attention, avoidance), focusing on reducing the distress associated with tinnitus rather than attempting to alter perceptions of the condition (Rief et al., 2005). Andersson, Strömberg, Ström, and Lyttkens (2002) found that CBT delivered through the Internet

resulted in significant clinical improvement. Similarly, Konzag and colleagues (2006) found that patients did equally well following a self-help manual as attending a counseling group. Such therapy could, therefore, be readily available to a large number of patients.

TRT similarly focuses on modifying psychological processes using "directive counseling" together with noise generators designed to foster habituation (Zachriat & Kröner-Herwig, 2004) by providing background sound at a level just below that of the tinnitus for 6–24 hr daily, including during sleep. Folmer and Carroll (2006) found that the majority of their patients (76%) gained some relief from generator use (Folmer & Carroll, 2006).

Both CBT and TRT reduce long-term disability (Zachriat & Kröner-Herwig, 2004). TRT may also reduce hyperacusis (Formby et al., 2008). However, many patients fear psychological therapies and may be reluctant to accept them (Rief et al., 2005). Others, believing that their tinnitus has an organic basis, seek medical rather than psychological help (Weise, Heinecke, & Rief, 2008).

Attempts have been made to identify pharmacological approaches to treatment. For example, as depression is positively correlated with tinnitus severity (Sullivan et al., 1988), antidepressants (e.g., amitriptyline, nortriptyline) have been used with some success (Dobie, 2003). Selective serotonin reuptake inhibitors have also been studied, though results have been inconclusive (e.g., Folmer & Shi, 2004). Melatonin, used to manage both tinnitus and tinnitus-related sleep disturbance (Megwalu et al., 2006), improved sleep in 46.7% of patients compared with 20% of those receiving placebo (Seidman & Seilesh, 2003). Although its impact on sleep was greatest among those with the worst sleep quality, its effect on tinnitus was not related to its severity. Sleep may also be enhanced by the use of bedside sound generators, though whether it is the associated relaxation or the presence of sound that is beneficial is unclear (Handscorn, 2006).

Intravenous local anesthetic agents (e.g., lidocaine) reduced tinnitus for limited periods in approximately 60% of patients (Simpson & Davies, 1999). Since such drugs are characterized by potentially serious side effects (e.g., respiratory depression, hypotension, bradycardia, cardiac arrest; Lockwood et al., 2002), they are not in general use. Other medications have been used with less benefit, including zinc (Paaske, Pedersen, Kjems, & Sam, 1991), cinnarizine (Podoshin, Ben-David, Fradis, Gerstel, & Felner, 1991), benzodiazepines (Johnson, Brummett, & Schleuning, 1993), baclofen (Westerberg, Robeson, & Stach, 1996), antiepileptics (Simpson, Gilbert, Weiner, & Davies, 1999), niacin (Benson et al., 2006), and neurontin (Bakhshaei et al., 2008). A further and more comprehensive review of drug therapies and tinnitus can be found in Darlington and Smith (2007).

Hearing aids may have some clinical benefit for affected patients, making them less aware of tinnitus and improving communication by reducing the annoying sensation that sounds and voices are masked by the tinnitus (del Bo & Ambrosetti, 2007). They can reduce tinnitus related to hearing loss by

amplifying external sound and diminishing awareness of tinnitus (Folmer et al., 2004). Tinnitus maskers may similarly be useful either in combination with a hearing aid or without amplification for some patients. Resembling hearing aids and fitting behind or in the ear, tinnitus maskers deliver either white or pink (low-frequency biased) noise (Vernon & Meikle, 2000). Effects may, however, be short-lived, and maskers are not effective for all patients, perhaps reflecting adaptation to masking without corresponding adaptation to tinnitus (Penner & Bilger, 1988). For some, tinnitus increases after masking, and maskers may interfere with hearing and communication (Benson, Robbins, & Hanks, 2006).

Some patients have also benefited from avoiding silence using environmental sound. As quietness, combined with some degree of hearing loss, increases the apparent loudness of tinnitus (Appelqvist et al., 2001), reducing the contrast between tinnitus and background sounds may make it less intrusive (British Tinnitus Association, 2008). Approximately 33% of sufferers use TV/radio or personal cassette/CD players for this purpose (RNID, 2007). Other external sources of sound, such as tabletop sound machines, speakers embedded in pillows, hearing aids, and bone-anchored or cochlear implants, may also be helpful.

Sound can also be used in other ways to manage tinnitus. Sound therapy relies on constant low levels of background sound to reduce subconscious "detectability" of tinnitus (Henry, Jastreboff, Jastreboff, Schechter, & Fausti, 2002). Gradually increasing levels appears to decrease sensitivity and reduce the intrusiveness of tinnitus, giving temporary comfort and enhancing habituation. However, "retraining" of tinnitus signal processing mechanisms may take 1–2 years.

Mixed success has been achieved using electrical stimulation in various ways in attempts to suppress tinnitus (Benson et al., 2006). Although Dauman (2000) claimed that stimulation reduces or abolishes tinnitus, findings have varied considerably (Rubenstein, Tyler, Johnson, & Brown, 2003). Benson and colleagues (2006) have suggested that effects are transient and continued stimulation is impractical. Cochlear implants have been used to deliver electrical stimulation with mixed results (Benson et al., 2006). Although some researchers have demonstrated beneficial effects (Baguley & Atlas, 2007), electrical stimulation is not currently considered a mainstream therapy for tinnitus.

Several studies have suggested that tinnitus severity is reduced by low-frequency repetitive transcranial magnetic stimulation (rTMS) of the temporal cortex (Plewnia et al., 2007). rTMS using neuronavigation imaging reduced tinnitus severity after 6 months compared with sham therapy (Kleinjung et al., 2005). Effects persisted for a year after treatment (Khedr, Rothwell, El-Atar, 2009). rTMS is believed to modulate the excitability of neurons in the auditory cortex, thus decreasing the hyperexcitability associated with some forms of tinnitus (Kleinjung et al., 2008). Although further studies regarding its long-term effectiveness are needed, this treatment may hold promise for treating chronic tinnitus (Benson et al., 2006; Kleinjung, et al., 2008).

Since current treatments have only limited success, many patients try some form of complementary/alternative therapy. Anecdotal evidence suggests that some of these therapies may be beneficial (Appelqvist et al., 2001). For example, reports suggest that clinical hypnosis is useful in treating troublesome tinnitus. Cope (2008), however, concludes that, though some patients may benefit, it is not clear how hypnosis compares to more mainstream approaches. More investigation into the effects of hypnosis is needed.

Acupuncture and ginkgo biloba are also popular alternative treatments. Randomized controlled clinical trials of acupuncture, however, while revealing some beneficial effects (e.g., improved sleep, decreased muscle tension, improved blood circulation), found that the treatment did not display efficacy (Park, White, & Ernst, 2000) or alleviate noise-induced tinnitus (Axelsson, Andersson, Gu et al., 1994). Similarly, though some trials suggested that ginkgo biloba was beneficial (Ernst & Stevinson, 1999), a Cochrane review drew no conclusions about its efficacy (Hilton & Stuart, 2004).

Both biofeedback and relaxation therapy have proved effective in managing some cases of stress-related tinnitus (Andersson & Lyttkens, 1999; Young, 2000). When used with CBT, biofeedback improved tinnitus-related annoyance, loudness and feelings of control, and changed coping cognitions and depressive symptoms (Weise et al., 2008). These improvements were maintained for over 6 months. Benson and colleagues (2006) similarly claimed that up to 80% of patients gain some relief from tinnitus and 20% find total relief using biofeedback. Biofeedback, thus, appears effective in decreasing the stress and anxiety contributing to tinnitus-related distress.

Discussion and Implications for Nursing Practice

Tinnitus is a widespread and potentially distressing symptom. Because the underlying cause is often unclear, managing tinnitus can be challenging; no single therapeutic approach benefits all patients (Baguley, 2007). As many professionals believe that tinnitus is a chronic or psychological condition, attitudes to care vary widely (Benson et al., 2006; Henry et al., 2005). Many patients are told to "learn to live with it" (Appelqvist et al., 2001; Folmer & Carroll, 2006). Those patients who are left untreated may feel isolated and believe that neither professionals nor others understand (RNID & BTA, 2006).

The presence of tinnitus may necessitate considerable adjustment to a patient's life associated with concerns about why it has developed, whether it indicates serious disease or will get worse (Andersson et al., 2005). The constant intrusiveness and loss of silence may be devastating along with the lack of sleep, concentration difficulties, and/or increased irritability (Lockwood et al., 2002; Andersson et al., 2005). As described above, most available treatments, therefore, focus on increasing understanding and reducing the impact of tinnitus using a combination of psychological and educational techniques.

Management of acute tinnitus is best achieved by a multidisciplinary team involving an otolaryngologist to identify underlying pathologies that may be amenable to treatment (Perry & Gantz, 2000), an audiologist, a psychologist, and, perhaps, a hearing therapist. In this situation, nurses have a number of important roles to play, including providing educational and supportive counseling and promoting stress reduction. Patients with chronic tinnitus may present in any area of a nurse's practice, so nurses will have many opportunities to care for affected patients and offer reassurance, information, teaching, and support.

Nurses must identify patients affected by tinnitus, assess their level of distress, and help them find ways of coping with the symptom. Simple acknowledgment of the condition may be the best first step nurses can take in caring for these patients (Davis & Morgan, 2008; RNID, 2007). Referral to local self-help groups or national organizations, such as the British and American Tinnitus Associations (<http://www.tinnitus.org.uk>; <http://www.ata.org>), can offer opportunities to share feelings and concerns which combined with positive thinking, helps to alleviate distress. Also, reassurance that tinnitus is unlikely to get worse and may improve or disappear spontaneously may help patients to modify negative thoughts and emotions (BTA, 2008), reduce distress, and help them to see that control may be possible. By reinterpreting their symptoms, many patients with tinnitus maintain purposeful and enjoyable lives (Sirois, Davis, & Morgan, 2006).

Because patient expectations are significant determinants of treatment success (Tyler, Haskell, Preece, & Bergan, 2001), it is important that nurses are positive and promote hope (Appelqvist et al., 2001) and that patients perceive providers as knowledgeable, caring, sympathetic individuals who understand their problem and recommend a clear treatment plan (Tyler et al., 2001).

Nurses can help patients with acute symptoms to develop realistic expectations about their care and treatment and provide ongoing support for those with chronic tinnitus. Advice on the available options for treating tinnitus and the associated psychological distress and encouragement to try different treatments may be helpful. Nurses might suggest referral to a hearing therapist so that patients can try using noise generators (Folmer & Carroll, 2006) or therapeutic sound (Henry et al., 2008). They might also suggest that patients try treatment modalities that may decrease the anxiety that contributes to tinnitus-related distress, such as biofeedback, relaxation therapy, yoga, massage, acupuncture, or clinical hypnosis.

In their teaching role, nurses can provide information about normal hearing, the influence of noise and quiet on the severity of tinnitus, and treatment options. They can also assist with determining the need for audiologic management, including remediation if hearing loss is present (Henry et al., 2008).

As hospitals are often excessively noisy (Biley, 1994), admission, for whatever reason, often exposes tinnitus sufferers to significant distress, especially if they also suffer from hyperacusis. Excessive noise has many negative effects and may be unsafe for both patients and clinicians (Johnson &

Thornhill, 2006). Environmental noise, disruption of the light/dark cycle, caregiver interruptions, pain and stress may reduce the ability to get adequate, restful sleep (Meissner et al., 1998) adding to the patient's distress, especially when hyperacusis is present. Although silence can itself enhance tinnitus—and cannot be expected in hospital environments—reducing noise levels can be beneficial to patients and staff alike. Encouraging patients to make positive efforts not to listen to their tinnitus and advice about ways of reducing its intrusiveness may break the vicious circle (Appelqvist et al., 2001). Background sounds, for example, may be distracting (Henry et al., 2002; RNID, 2007; BTA, 2008), promoting habituation, aiding symptomatic relief, and helping patients to develop coping strategies (Andersson et al., 2005).

Conclusion

Tinnitus, which affects millions of people worldwide, is rarely acknowledged as the widespread and intractable condition that it is. Affected patients may need considerable care and support, recognition that help and hope are available, advice on their options, and encouragement to try different treatments. They need to believe that those caring for them are knowledgeable and understand their problem. However, given the paucity of relevant literature, an information deficit among nurses may make this difficult to achieve.

Ensuring that patients are protected from harm is an important role for nurses, yet they and other health care professionals often overlook the needs of those with tinnitus. Quality of life depends on the interactions among physical, psychological, and social factors. Tinnitus has the potential to severely disrupt these interactions. The goal of truly holistic care that is at the core of nursing is a crucial element of treating patients with this condition.

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