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Managing Older Adults with Cognitive Health Worries

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Longevity Revolution

Compared to a century ago, the average human life span has doubled, thanks to improved hygiene, medical care, and living conditions. A 2021 Canadian national census shows seniors over 85 comprise one of the country's fastest-growing demographics.[1] The population of that age group is expected to triple over 30 years. Around the same time, the Lancet Commission on dementia projected a similar increase in people with cognitive impairment.[2] Knowing the absence of a cure and its overwhelming impact on affected people, families, and society, global initiatives have been developed promoting healthy aging interventions focused on preventing and treating dementia's associated health conditions.[2–15] The Commission estimated that up to 40% of dementia cases could be prevented or delayed by modifying 12 risk factors throughout life (e.g., hearing loss, hypertension, diabetes).[2]

Healthy Aging Business

These statistics have been noticed by the health and wellness industry looking for new revenue streams. Data collected from social media activity and browsing behavior patterns allow these businesses to identify and target consumers with cognitive health worries and market possible solutions (e.g., pills, dietary supplements, brain training computer games).[3] While raising awareness about dementia may promote early access to treatment, advertising unproven products and services may also increase the risk of harm. Audiologists are, therefore, expected to see a significant increase in older patients with questions and concerns about memory and other thinking abilities. This article proposes a brief overview of age-related hearing loss and cognitive decline and a review of old and new clinical tools commonly used in assessing and managing older patients at risk of dementia.

Age-Related Hearing Loss

The majority of older adults have some changes in their hearing.[4,5] In Canada, the incidence of hearing health problem shows that 77% of adults between the ages of 60-69 and up to 94% of adults between the ages of 70 and 79 have audiometrically measured hearing loss, subjectively reported tinnitus or both conditions.[4,5] Age-related hearing loss (ARHL) refers to the natural decline in hearing that occurs as people age. Signs and symptoms include difficulty hearing, trouble understanding speech-in-noise, tinnitus, decreased sound tolerance and lower well-being

(i.e., loneliness, social isolation, anxiety, depression). ARHL, also known as *presbycusis*, is a progressive degeneration of the peripheral auditory system, mainly resulting in a bilateral, symmetrical sensorineural hearing loss primarily observed in the high-frequency region.[6, 7] Although not as documented, alterations within the central auditory nervous system can also lead to auditory processing deficits.[7,8–12] Several studies using neuroimaging techniques such as magnetic resonance imaging (MRI) have shown reduced grey matter volume in auditory and non-auditory brain regions (e.g., thalamus, hippocampus, prefrontal cortex) in older adults with a prolonged history of hearing loss compared to normal hearing subjects.[9–11] Furthermore, the American Academy of Audiology Task Force on Central Presbycusis supports the existence of auditory processing disorders arising from a combination of factors involving age- and disease-related issues and changes in cognitive function.[12] Recent evidence suggests that deficits in central auditory processing (CAP) may be a harbinger of dementia.[13] Some studies have found that people with Alzheimer's disease (pre-symptomatic stage) have impaired CAP compared to healthy older adults.[11,13,14] Table 1 lists conditions and disorders precipitating the development of age-related hearing loss.[7,8]

Noise Exposure
Genetic Predispositions
Repeated Head Injury
Ototoxic Drugs
Infections
Chronic Health Conditions (Hypertension, Diabetes, Depression)

Table 1. Conditions and Disorders Precipitating the Development of Age-Related Hearing Loss

Cognitive Decline

As people age, changes to the structure and function of the brain may also result in cognitive decline.[2,8,15] Signs and symptoms vary on the severity of cognitive impairment and may include memory loss, word-finding difficulty, trouble following conversations, frequently misplacing items, confusion about time and space, difficulty solving problems, and withdrawal from social activities.[16,17] Similar to hearing loss, these changes can occur due to normal aging and/or health conditions and disorders that may interfere with a person's ability to perform activities of daily living (ADL; getting dressed, paying bills, managing medications).[16] *Normal Cognitive Aging* refers to a subtle decline in mental processing speed, attention, and working memory.[16,17] Although worrisome, these age-related changes do not typically affect the brain's ability to manage high-order processes such as memory and executive function. *Mild Cognitive Impairment* (MCI) is often considered a transitional stage between normal cognitive aging and dementia. MCI is characterized by a recent and noticeable decline in cognitive abilities but not severe enough to interfere with ADL.[16,17] *Dementia*, however, is classified as a major neurocognitive disorder.[18] It is characterized by a significant decline in cognitive function affecting a person's ability to carry out ADL.[17,18] The incidence of MCI and dementia also increases with age. It is estimated that about 2–3% of adults aged 70 to 75 years and 20–25% of adults aged 85 years and older have some degree of cognitive

impairment.[15] Table 2 lists conditions and disorders precipitating the development of MCI and Dementia. Reduced blood flow and build-up of abnormal proteins (e.g., beta-amyloid, tau) in the brain, gold standard biomarkers for neurodegenerative diseases, can lead to cerebral atrophy over time.[8,9,11] Alzheimer's disease is the most common form of dementia, followed by vascular dementia, frontotemporal dementia, Body Lewy dementia and Parkinson's disease.[15] While most cases of dementia are progressive and irreversible, cognitive loss as a secondary disorder to a pre-existing condition (e.g., infection, vitamin deficiencies, depression, neurotoxic drugs, hearing loss) can sometimes be treated and reversed.[19]

Aging
Genetic Predispositions
Sensory Impairment (e.g.: Hearing Loss)
Repeated Head Injury
Neurotoxic Drugs (Anticholinergics)
Infections & Chronic Health Conditions (Hypertension, Diabetes, Depression)
Lifestyle Factors (Physical Activity, Smoking, Excessive Alcohol Consumption, Obesity)

Table 2. Conditions and Disorders Precipitating the Development of MCI and Dementia

Association between Hearing and Cognition

Epidemiologic studies have shown a statistically significant association between age-related hearing loss and increased risk of MCI and dementia.[8,9,11,21] Although the nature of this correlation remains to be clarified (i.e., causal or non-causal) with high-quality randomized control trials, several mechanisms have been proposed to explain the link between these two health conditions among older adults.[8,20,21,22] The *sensory deprivation* hypothesis stipulates that structural changes observed in the auditory cortex from prolonged hearing loss may lead to cognitive decline.[7,8,20] The *information degradation* hypothesis theorizes that the brain may have to work harder to process degraded auditory input, leading to cognitive load, fatigue and decline over time.[7,8,20] The *cascade via social effects* hypothesis suggests that untreated hearing loss may lead to social isolation and loneliness, increasing the risk of depression and cognitive decline.[7,8,20] Finally, the *common cause* hypothesis argues that a third variable, microvascular disease, may lead to age-related hearing loss and cognitive decline.[8,20]

Comprehensive Audiological Assessment

Beyond cognitive impairment and poor emotional well-being, ARHL has also been linked to an increased risk of fall and mortality before age 75.[23,24] The pervasive medical myth of ARHL as a benign consequence of advancing years has finally been shattered. Instead, ARHL is considered a significant health problem and consistently ranked fifth as a leading cause of years lived with disability in the global disease burden.[25] Left untreated, these chronic health conditions can amplify distress associated with the experience of ARHL and jeopardize the effectiveness of audiological intervention(s). It is, therefore, critical to expand the evaluation process beyond the traditional hearing test to obtain a more precise clinical picture of patients' symptom(s) presentation, prevent

inaccurate diagnoses and avoid ineffective treatment option(s).

Detailed Case History

As service referral requests rarely indicate a formal diagnosis of MCI and/or dementia, case history form needs to include specific questions about memory and the ability to carry out ADLs.[26] “Have you noticed changes in your memory and/or other thinking abilities?” If so, “are these changes more frequent than it was about 1 year ago?” “Are you having difficulty finding words?” “Are you frequently misplacing items?” “Do you need assistance paying bills and/or managing medications?”

Moreover, signs and symptoms of cognitive decline may also be observable to clinicians. Is the patient repeating the same story over and over? Is the patient confused over simple instructions or audiometric tasks? Is the patient exhibiting inappropriate affect?

Speech-In-Noise Testing

Trouble understanding speech in background noise is the most common problem reported by older adults with hearing loss.[8,12,27] Although critical in hearing evaluation, a pure-tone audiogram mostly provides information about auditory thresholds across a frequency range. Likewise, monosyllabic word recognition testing in quiet does not reflect listening ability in real-world environments. As the audiogram is a poor predictor of functional hearing ability in challenging listening conditions, additional suprathreshold auditory measures are needed to detect and manage comorbid auditory and cognitive processing deficits. Speech-in-noise tests are designed to specifically evaluate patient’s ability to recognize speech in background noise, which may be more representative of the brain’s health.[11,27] The processing of information in noisy environments involves a complex interplay of auditory and cognitive abilities, including detection of acoustic signals, localization of sound sources, encoding of speech sound features, suppression of unwanted noise, attentive tracking of the sound source of interest, storage and recall of information in working memory, decoding and understanding of spoken message.[36] Therefore, patients with subjective cognitive complaint(s) and poor score at a speech-in-noise test may exhibit early signs of cognitive decline.[11,13] A recent longitudinal study of 702 participants aged 60 years or older, found a robust association between decreased speech-in-noise performance at the QuickSin test and poor cognitive score at baseline and faster decline in cognitive score compared to participants with better QuickSin score.[28]

Several easy-to-administer psychoacoustic and self-report measures can be used to identify and quantify auditory processing deficits related to cognitive abilities.[29] The Quick Speech-in-Noise test (QuickSin) and the Words-in-Noise test (WIN) are both clinical tools designed to assess patients’ hearing ability in background noise in a monaural presentation.[30,31] The Hearing in Noise test (HINT) and the Listening in Spatialized-Noise Sentences Test (LiNS-S) are also measures intended to evaluate patients’ speech processing ability in noisy environments in a binaural presentation.[32,33] Additionally, self-report questionnaires such as the Speech Spatial and Qualities of Hearing Scale (SSQ) and the Abbreviated Profile of Hearing Aid Benefit (APHAB) can provide subjective measures of patients’ perceived hearing ability in different listening conditions.[34,35]

Finally, suprathreshold auditory measures such as the Dichotic Digit Test (DDT) and the Word Auditory Recognition and Recall Measure (WARRM) can be used to investigate patients' auditory working memory and attention abilities.[36,37] Some studies have proposed that hearing aid with slow-acting compression may provide better-aided speech recognition for patients with limited working memory resources.[38] Information obtained with these psychoacoustic measures can guide future rehabilitative intervention(s) such as selecting suitable electroacoustic features in hearing aids (e.g., compression strategy).

Cognitive Screening Testing

There is a variety of pen-and-paper screening measures currently used to quickly and easily assess patients' cognitive function such as the Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Saint Louis University Mental Status Exam (SLUMS) and Quick Mild Cognitive Impairment Screen (Qmci) to name a few.[39–42] Cognivue, a computerized cognitive screening device, has recently gained popularity among medical and health professionals.[43,44] Additionally, free self-screening tool kits, such as the Self-Administered Gerocognitive Exam (SAGE), TestMyBrain and Cogniciti, are also available online for patients curious about or concerned with their cognitive health[45,46]. These self-screening tool kits are great resources for clinicians lacking the knowledge-based skills, and training needed to provide safe and effective cognitive screening services in the clinic. Whether dispensed by professionals or self-administered by patients, these screening tests can provide invaluable information about cognitive function among patients who have not already been diagnosed with MCI or dementia. Depending on the cognitive screening measure selected, these tests can evaluate patients' performance in complex cognitive domains (e.g., orientation, attention, memory, language, executive function, visuospatial skills, calculation, reasoning) and simpler ones (e.g., processing speed, reaction time).[26,47] The accuracy, sensitivity and specificity of these screening tests, however, can significantly vary depending on several factors such as the stage of cognitive decline being targeted (i.e., MCI or dementia), population being tested (i.e., native/non-native English speakers) and accessibility of administration methods (i.e., adapted/non-adapted for hearing and vision loss).[47] Therefore, it is critical to research the available tools before selecting the best cognitive screening measure for the clinic.

Cognitive screening, however, is not intended to diagnose neurocognitive disorders nor specific neurodegenerative diseases such as Alzheimer's disease.[22,47,48] Diagnosing dementia requires a collaborative transdisciplinary team approach as it involves a combination of medical consultations, neuropsychological evaluations, diagnostic imaging and laboratory tests.[48,49] Primary care physicians, medical specialists (e.g., neurologists, geriatricians), and clinical psychologists are the only healthcare professionals permitted to officially diagnose MCI and dementia. Therefore, before cognitive screening services can be successfully implemented in the clinic, audiologists must develop a referral network in their community to connect patients with the appropriate specialists and resources for proper care.

Effective Counseling

Effective counseling in Audiology refers to the provision of informational and personal adjustment

services within the person- and family-centered care approach[50]. The goal is to provide clear, up-to-date, evidence-based, and unbiased information to assist patients in making informed-decision about different treatment options needed to move toward functional change. Research shows that discussion about changes in cognitive function and need for further evaluation may trigger difficult emotions such as anger, fear, anxiety and shame due to the stigma associated with dementia [26, 51].

This process is best performed with empathy and compassion[52]. Understanding patients' experiences without judgement creates a safe and supportive environment needed to explore this health issue. Patients may also push back and question clinicians' brain and cognitive health expertise. Once again listening and validating patients' feelings is an integral part of this collaborative process. The quality of clinician-patient alliance is a reliable predictor of positive clinical outcome independent of treatment approaches.[53] Clinicians want to highlight the notion that age-related hearing loss can affect not only ear structures but also brain tissue. Using a medical illustration depicting the central auditory pathway projecting to non-auditory brain regions responsible for working memory, attention, and executive functions can help patients better understand the nature of their hearing difficulty. Educating patients that great hearing rests not only on their ability to perceive sound but also on their ability to process information effectively may help readjust expectations with treatment options.

Hearing Aid Benefits

Over the last decade, patients have been bombarded with ads selling the benefits of hearing aids on brain health. Audiologists are asked daily if using a hearing aid will prevent onset of cognitive decline and/or mitigate the trajectory of dementia. It can be quite challenging to communicate research data in a concise and easy-to-understand manner to avoid misinformation and harm. Creating a patient education pamphlet can help prevent misunderstandings and false hopes from products and services recommended. Based on current research evidence hearing aid and implant cochlear usage can significantly impact hearing ability and cognitive screening test performance.[8] More research is needed to fully elucidate hearing intervention's therapeutic or protective effects on cognitive health.[8,22,54,55] In the meantime, it remains universally agreed that the benefits of hearing aids include improved communication abilities, psychosocial well-being and overall quality of life.[8,26]

Auditory & Cognitive Training

Auditory Training (AT) is designed to improve speech perception and is routinely provided to patients receiving a cochlear implant post-op. AT takes advantage of neuroplasticity through systematic and structured listening exercises at home or the clinic. Over the last 10 years, however, computer-based AT programs and games have been heavily advertised to older patients with trouble understanding speech-in-noise and/or utilizing hearing aids in background noise. At this time, however, evidence from several randomized controlled trials investigating the effectiveness of these AT programs among patients with ARHL has not shown a lasting effect or transfer of learning into real-world situations.[56–58]

Research is being conducted on the potential benefit(s) of combining Auditory and Cognitive Training (CT) programs in older adults with hearing loss.[59] The goal of this study is to determine

whether or not this type of training can improve not only speech perception in noise, but also memory, attention and executive function. As for AT, CT is designed to improve cognitive abilities through systematic and structured cognitive exercises and activities.

Keeping the Brain Fit

As with any other parts of the body, the brain ages. Although cognitive aging is inevitable, some patients will start showing decline earlier than others. While age is the most significant risk factor for MCI and dementia, there are evidence-based strategies that can potentially promote brain health.[2,8,26]

- *Encourage connection with family, friends, and communities*. Audiologists gain in explaining that hearing aid use can help improve hearing and communication abilities, social interactions, mood, and confidence.
- *Advocate healthy lifestyle factors* such as good diet, drinking with moderation, smoking cessation, and sustaining physical activity at least 3 times a week.
- *Promote participation in more brain-stimulating activities* includingreading books, making crossword puzzles, playing card games, going to the theater, listening and dancing to music. Although evidence is limited, one study found that learning new skills may improve memory, attention and thinking abilities, increase self-esteem, social interactions and reduce stress.[60]

Increased longevity comes with incredible blessings and challenges. Audiologists must recognize the overwhelming impact of age-related hearing loss on an individual’s quality of life. Beyond communication difficulty, poor hearing may affect cognitive health, increase risk of falls and injuries and lead to lower well-being. Clinicians are called to expand the traditional evaluation process and management strategies to provide appropriate care and support to this vulnerable population.

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