

Hearing impairment in dementia – how to reconcile two intertwined challenges in diagnostic screening

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Hearing impairment in dementia

Prevalence of dementia as well as hearing impairment is increasing with age. As a consequence older people are often affected by both conditions. Especially among the people with dementia a majority also has significant hearing problems. With population aging and more people getting even older the number of these patients will increase immensely over the next years.

Dementia refers to a spectrum of brain disorders, all of which involve cognitive impairment but vary widely in terms of the cause, course, and prognosis. Dementia is more than just memory impairment; it involves impairment in multiple areas of cognition. Prevalence of dementia exponentially increases from 2% of people under the age of 65 years with doubling of numbers every five years up to 30-50% at the age of 90 years. Dementia is the leading cause of institutionalization among the elderly. Prevalence among elderly nursing home residents is estimated to be 60-80%. In the clinical category of dementia Alzheimer's disease is by far the most common type of dementia with about 50-70% of all cases, whereas vascular dementia accounts for approximately 20%. Much overlap is encountered here because about 30% of patients with Alzheimer's disease also have vascular dementia. Dementia due to Lewy body disease accounts for almost 20% of all dementia, whereas all other types of dementia represent less than 10% of all cases (Agronin, 2004; Lobo, *et al.*, 2000).

Prevalence of hearing impairment is estimated at 30-40% in population aged 65 to 74 years and at 50% to 80% in population aged 75 years

and older depending on the criteria for hearing loss and the recruiting procedures used in the study (Cruickshanks, *et al.*, 1998; U.S. Congress, 1986). Aging primarily affects hearing at high frequencies, which has an impact on the perception of high-pitched and low energy speech sounds in particular. Presbycusis, as the age-related hearing impairment is referred to, is often associated with additional difficulties besides elevated thresholds for high frequencies. These difficulties become particularly evident in complex or noisy listening situations and reveal problems with frequency resolution, temporal resolution, localization, separation of speech in background noise, or understanding in reverberant surroundings (Pichora-Fuller & Souza, 2003; Wingfield, 2000). Referring to the International classification of functioning, disability and health (ICF; WHO, 2001), the impact of these sensory changes for an individual becomes most apparent when activity limitations and participation restrictions in everyday life are taken into view. Common complaints that result from hearing impairment include: difficulties communicating in noisy environments; with fast speakers, unfamiliar speakers, people with an accent; difficulties to participate in group discussions with multiple talkers; to comprehend on the phone; to attend concurrent activities often leading to a sense of disorientation and insecurity for instance in road traffic; no longer enjoying music or singing; as well as missing sounds of nature. Moreover, there are strong emotional reactions resulting from these problems, they are often described as feeling isolated, trapped within one's own world, making oneself unpopular, a sense of insecurity in everyday life, or experiencing *an awful silent world*. Research shows that hearing impairment certainly has an impact on health-related quality of life, psycho-social, and emotional functioning and is particularly related to depression, loneliness, anxiety, distress, and somatization (Nachtegaal, *et al.*, 2009; Arlinger, 2003). Little attention in research has been paid so far to the association of hearing and cognition, although understanding of speech constantly requires interaction of bottom-up and top-down information processing. The analysis of sensory information from the rapid speech stream depends on cognitive abilities like for instance selective attention, working memory, and semantic knowledge. In that way, one could say, good hearing provides stimulating input to the brain and thus enables cognition. Besides, good hearing is a pre-condition to participate in engaging social interaction and communication and thus challenges the brain. In addition, good hearing also facilitates orientation, supports a sense of security and thus enables activities of daily living and autonomy in old age. In contrast, if left untreated, presbycusis of a moderate or greater degree affects communication and social participation, it can contribute to isolation, depression, and, possibly, dementia. Hearing loss is known to exaggerate the effects of cognitive deficits (Uhlmann, *et al.*, 1989) and has been found to predict more rapid cognitive decline (Peters, *et al.*, 1988; Uhlmann, *et al.*, 1986). It has been suggested that hearing intervention has the potential to slow down cognitive decline in dementia (Wahl & Heyl, 2003; Peters, *et al.*, 1988). Clearly, improvement of hearing has been shown to reduce disability caused by hearing impairment in patients with dementia and in their caregivers (Allen, *et al.*,

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2003). Moreover, in one study caregivers indicated that not only hearing handicap can be reduced by hearing improvement, but also problem behaviors frequently associated with dementia, such as forgetting, searching, asking for repetition, anxiety, aggression etc. (Palmer, *et al.*, 1999). In that way improvement of hearing in patients with dementia could be seen as a way to reduce caregiver burden and may help to delay or even prevent institutionalization in the course of the disease.

The dilemma of screening procedures

Early diagnosis is crucial in dementia for identifying and treating reversible causes, exacerbating factors, and associated psychiatric problems. The same is true for early identification and treatment of hearing impairment and regular screening is promoted. As a result the American Speech-Language-Hearing Association (ASHA, 2010) for instance recommends that adults should be screened at least every decade through age 50 and at 3-year intervals thereafter. In clinical practice the two problems of hearing and cognition are usually addresses separately and unfortunately professionals in both fields rarely refer their clients to the other specialist. Also, ENT doctors and audiologists as well as dementia specialists experience difficulties to take the additional cognitive or sensory challenges of their clients into account for diagnostics and treatment. In dementia screening hearing problems are often not realized, nor compensated or considered during testing, whereas in hearing screening cognitive problems are often not realized, nor taken into account during testing. In both cases incorrect diagnoses may result. What makes matters worse is the fact that clients with dementia are mostly not considered as candidates for hearing technology and even hearing screening is often not performed due to expected difficulties to perform standard procedures. The reasons for these possible difficulties are revealed, when analyzing the neuropsychological prerequisites for successful performance on screening procedures for hearing or for dementia. Taking one of the most commonly used screening test for cognitive functions as an example, the Mini Mental State Examination (Folstein, *et al.*, 1975) requires oral instruction throughout its administration. Also, test instruction explicitly prohibits the repetition of certain items by the examiner because this could facilitate memory tasks and compromise test results. Moreover, two items of the MMSE primarily address speech comprehension asking the patient to immediately repeat three words or a sentence respectively that the examiner had said just before. With these examples in mind it becomes clear how easily the result of a cognitive screening test can be compromised by a hearing problem. However, compensation for hearing impairment during cognitive screening by using assistive listening devices is still an exception. On the other hand, apart from the visual inspection of the ears, commonly used procedures for hearing screening like for instance assessment of case history, a whispering test, pure-tone audiometry, self-assessed judgment of hearing difficulty, screening via telephone or internet are all asking for cognitive abilities like attention, working memory, semantic knowledge in order to attend, comprehend, remember, execute instructions and to communicate with the examiner. Thus, limitations of the available screening instruments as well as typical challenges for the diagnostic differentiation between the two intertwined problems can be demonstrated.

Clinical experience and recommendations

We conducted qualitative interviews in Germany (N=10) and in the US (N=15) with clinical audiologists and hearing instrument specialists, who do hearing screening and hearing instrument fitting for clients with

dementia. All agreed that conventional pure-tone audiometry, where individuals are instructed to raise their hand (or point to the appropriate ear) when they hear a tone, is the commonly used procedure for the hearing screening. They reported the following frequently observed problems when performing hearing screening in clients with mild cognitive impairment or dementia:

- new, irritating situation causes nervousness and insecurity
- difficulties to comprehend oral instruction
- forgetting of instruction in-between
- placement of ear phones on the head causes irritation
- unfamiliar surrounding, new people, movements cause distraction

All participants agreed that in the early stages of dementia pure-tone audiometry and often also speech audiometry are generally applicable, although modifications may be necessary. In the later stages of dementia disease objective tests (e.g. otoacoustic emissions, auditory steady-state response) may be necessary to obtain estimated thresholds. Hearing technology is generally found to be applicable and beneficial for patients with dementia and their caregivers given that screening and fitting procedures are adapted to the special needs of clients with dementia. Participants of the study give the following recommendations how to address possible problems during hearing screening:

- consider a house call;
- relax, take enough time, slow down the speed of testing;
- allow the caregiver to accompany the client (also into the booth);
- simplify instructions, use short sentences, allow for pauses;
- give examples, demonstrate, allow for trial runs;
- let the client repeat what he/she is supposed to do, to be sure the client understands the procedure;
- have the client respond with yes instead of reacting with a button or by raising a finger;
- remind to respond throughout the testing;
- present pulse tones instead of continuous ones;
- create a friendly atmosphere, be empathetic, work with mimic and gesture.

Conclusions

Hearing health care professionals agree on the notion that all clients with hearing impairment require thorough examination. This is also true for clients with mild cognitive impairment or dementia that have traditionally been considered difficult or impossible to test for hearing impairment. Clinical research and practice show that with some modifications in procedures clients with dementia can reliably participate in standard audiometric procedures (Burkhalter, *et al.*, 2009; Allen, *et al.*, 2003; Palmer, *et al.*, 1999; Weinstein & Amsel, 1986) and hearing aid fitting (Allen, *et al.*, 2003; Palmer, *et al.*, 1999). Our qualitative data from knowledgeable frontiers in the field provide ideas for successful adaptations of clinical practice for clients with dementia. Their promising experiences can serve as starting points for further research on how to provide and improve audiological service and rehabilitation for clients with dementia. That it is worth the efforts is supported by research results demonstrating that dementia patients and their caregivers benefit from hearing improvement in the sense of reduced handicap and reduced burden of care (Allen, *et al.*, 2003; Palmer, *et al.*, 1999). It is indicated that good hearing enables activities and participation in daily live as well as it has the potential to slow down cognitive decline in dementia (Wahl & Heyl, 2003; Peters, *et al.*, 1988). As a consequence, it is critical that audiologists make other health care providers aware of the negative effects of untreated hearing impairment in old age. Failing to address hearing impairment does not only affect communication, restrict social participation, contribute to isolation and depression, but could also accelerate cognitive decline in old age and in dementia.

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