

HEARING LOSS AND DEMENTIA: CONNECTING THE DOTS

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LEARNING OBJECTIVES

The participant will be able to:

- Identify age-related sensorineural hearing loss and dementia.
- Distinguish hallmark signs and causes of dementia.
- Differentiate dementia from other neurologic diseases and syndromes.

CHRONIC CO-MORBIDITIES OF HEARING LOSS

Physiological Conditions

- Hypertension
- Cardiovascular Disease
- Arthritis
- Chronic kidney disease
- Stroke
- Falls
- Diabetes
- Cancer

Psychosocial Consequences

- Cognitive Disorders (Dementia/Alzheimer's Disease)
- Communication Disorders
- Depression
- Infectious diseases
- Quality of Life

- Age-related hearing loss has contributed to faster declines in other disorders.
 - Dementia/cognitive disorders
 - Untreated hearing loss is an independent variable
 - Balance disorders
 - Hypertension, diabetes, and ototoxic drugs
- Hearing loss can threaten health outcomes particularly older aged adults.
- Older adults with hearing loss develop brain shrinkage faster.

AGE RELATED HEARING LOSS (ARHL)

- Chronic health condition
- Presbycusis
- Gradual process
- Bilateral high frequency sensorineural loss, symmetrical
 - Peripheral and central pathology
- Progressively impacts mid to low frequencies
- Poor speech understanding in noise
- Hyperacusis and tinnitus present
- Absent or undetected otoacoustic emissions
- dependent on hearing loss severity

CAUSES OF ARHL

- Most Common – inner ear changes from aging
- Central changes impact perceiving auditory verbal and nonverbal stimuli
- Certain medications
- Morphological alterations (stria vascularis)
- Central Auditory Pathway Degeneration
- Genetics
- Environmental exposure to noise
- Metabolic disorders
- Lifestyle choices
 - Smoking – hypertension
 - Lack of exercise/diet - obesity
 - Noise exposure
 - Dietary habits

ARHL PATHOPHYSIOLOGY

o Schuknecht's 1974 Classification system based on:

- Audiometric pattern of hearing loss
- Inner ear vasculature abnormalities
- Hair cells and membrane abnormalities
- Thorough case history and temporal bone analysis

o Four Classifications - 1974

- Sensory
- Metabolic or Strial
- Neural
- Cochlear conductive

(Blevins, Duschler, & Kunins, 2018; Jayakody et al., 2018)

CENTRAL AUDITORY SYSTEM – AGING MECHANICS

- o Animal and human studies investigation on patho-physiological changes associated with aging. (Yamasoba, et al., 2013)

CHANGES IN CENTRAL AUDITORY PATHWAY (CAP) FROM ARHL

o Neuroimaging results show changes in :

- Gray matter volume decline in middle and superior temporal gyri, primary auditory cortex, both medial and superior frontal gyrus, occipital lobe, and the hypothalamus
- Both gray and white matter decline near auditory cortex
- Secondary pathophysiological change in CAP, and other brain areas not related to auditory stimuli processing.

(Jayakody, et al., 2018)

SYMPTOMS

- o Understanding family/friends/medical professionals (poor socialization)
- o Unable to follow directions
- o Unable to hear phones, warning alarms, doorbells
- o Leads to feelings of isolation
- o Can hear but “can’t understand”
- o Leads to depression
 - A hearing loss that goes untreated can contribute to depression, isolation, and cognitive decline.
- o Balance/fall issues

CHARACTERISTICS OF ARHL

- o Hearing deficits with competing background noise.
- o ARHL patients hear fine in one-on-one in quiet.
- o Cocktail party effect – difficulty in social settings – isolation.
- o Women’s voices harder to hear than men.
- o The majority of a soundwaves energy lies in the lower and mid-frequencies in human speech.
- o High frequencies carry the consonants that give meaning to words. Some are soft sounds.
- o Central hearing loss isn’t corrected with hearing aids

LIN ET AL., 2013 STUDY

- o Objective: to determine an association between hearing loss and cognitive decline.
 - **Subjects:**
 - o 1984 older adults with a mean age of 77.4 years old.
 - o Baseline showed no cognitive impairments.
 - **Method:**
 - o Used the Modified Mini-Mental State Examination Test [3MS] with score greater or less than 80 and puretone average at 500 to 4000 Hz in the ear with better hearing.
 - **Results:**
 - o 1162 patients with hearing loss of 25 dB PTA showed declines annually in 3MS (41%).
 - o 32% greater declines with the Digit Symbol substitution scores than subjects with normal hearing at baseline.
 - **Conclusion:**
 - o Cognitive decline is associated with hearing loss.
 - o A correlations between cognitive decline and peripheral and central hearing loss exist (p. 293).

- Older white male smokers showed higher prevalence of hearing loss and cognitive decline.
- A 30-40% accelerated cognitive decline rate and a 24% (Lin et al., 2013) risk increase for impairment.
- Faster decline in hearing impaired vs. normal hearing individuals (7.7 years vs. 10.9 years).
- Cognitive load or social isolation can connect hearing loss and cognitive decline mechanistically.

EFFECTS OF HEARING AIDS, AURAL REHABILITATION, COCHLEAR IMPLANTS ON DEPRESSION AND COGNITIVE FUNCTION

- Italian researchers Castiglione, et al., 2016 reviewed effects on mental and cognitive decline
- Method:
 - 125 older adults (> 65 years) with hearing loss (105) and normal hearing (20)
 - 6 study groups based on degree of loss
 - Rehabilitation with cochlear implants or hearing aids
- Routine cognitive and hearing assessments (before/after rehabilitation)
 - Digit Span test
 - Stroop color-word test
 - Montreal Cognitive Assessment (MoCA)
 - Geriatric Depression Scale

(Castiglione, et., 2016)

RELATIONSHIP BETWEEN HYPERACUSIS, TINNITUS, AND SEMANTIC DEMENTIA

- A 2011 study by Mahoney, et al., evaluated MRI data from patients with auditory symptoms and semantic dementia.
- Grey matter in posterior superior portion of temporal lobe preserved
- Grey matter in orbitofrontal cortex and medial geniculate nucleus reduced
- Orbitofrontal cortex atrophy – tinnitus
- Medial geniculate nucleus or auditory thalamus atrophy – hyperacusis

TAKE AWAY:

- The Lancet International Commission on Dementia Prevention, Intervention, and Care (Livingston et al., 2017) suggests that one-third of diagnosis of Alzheimer's Disease (AD) could be prevented or delayed with life style changes, early intervention, and adhering to public health strategies (e.g. correcting hearing impairments).
- Current projects that one in 30 Americans will have dementia by 2050 (Taylor & Tysoe, 2015).
- Hearing loss older adults have a 30-40% greater chance of acquiring dementia or a cognitive decline (i.e. memory issues).
- Older adults with even mild hearing loss untreated will have processing problems.
- Prevention could reduce the number of patients with AD by 2050 from 8.8 to 16.2 million (Jayakody et al., 2018; Livingston et al., 2017).
- Mild cognitive impairment (MCI) can be a pre-cursor to dementia. Over a fourth of older adults 65 years and older have MCI (Livingston et al., p. 2689).
- Hearing loss can cause:
 - Difficulties attending –working memory
 - Visual and auditory free call tasks
 - Longer latency needed for accurate judgements in perception
 - Isolation and depression

Dementia

WHAT IS DEMENTIA?

- Neurological syndrome caused by different brain diseases.
- High prevalence among aging population
- Congenital
- Organic
- Caused by infections and toxicity
- medicine reactions
- Symptom severity progress until death

(ASHA., (n.d). Dementia)

NEURODEGENERATIVE DISEASES ASSOCIATED WITH DEMENTIA

- Alzheimer Disease
- Lewy Body Disease
- Vascular pathology (e.g., multi-infarct Dementia)
- Frontotemporal lobar degeneration
 - Pick's Disease
 - Primary Progressive Aphasia
- Huntington's Disease
- Parkinson's Disease
- HIV/AIDS or neuroAIDS dementia (Manasco, p.59)

(ASHA, (n.d). Dementia)

WARNING SIGNS OF DEMENTIA

- Confusion and memory loss
- Work problems
- Problems paying bills or housekeeping
- Personality changes
- Depression
- Problems following simple directions
- Trouble expressing wants and needs to others
- Eating and swallowing problems

(ASHA, (n.d). Dementia)

ETIOLOGY FROM PROGRESSIVE CHANGES IN FUNCTION OF BRAIN

- Wernicke-Korsakoff Syndrome secondary to chronic alcohol abuse
- Traumatic Brain Injury (TBI)
- Chronic Traumatic Encephalopathy due to repeated trauma (e.g., dementia pugilistica)
- Chemotherapy (Kean & Locke, 2008)
- Multiple Sclerosis
- Human immunodeficiency virus (AIDS/HIV)

(ASHA, (n.d). Dementia)

DEMENTIA CHARACTERISTICS

- Attention Deficits
 - Easily distracted
 - Difficulties without input being restricted or simplified
 - Decreased information-processing
 - Longer speed-thinking processes than usual
- Learning and Memory Deficits
 - Episodic memory deficits (e.g., specific autobiographical events, situations, and experiences)
 - Short-term and working memory deficits-
 - rapid forgetfulness
 - recent auditory/visual stimuli

(ASHA, (n.d). Dementia)

COMMON SYMPTOMS

- Reasoning and Executive Functioning Deficits
- Insufficient goal and planning difficulties
 - reliance on others
- Impaired reasoning and poor judgement
 - safety concerns
- Inabilities in multi-tasking and complex
- Lack of inhibition
- Lack of mental flexibility

COMMON SYMPTOMS (CONT'D)

- Perceptual Deficits
 - Impediment of completion of familiar activities
 - Loss of recognition of familiar people, common objects, sounds, etc.
 - Inability to find objects in direct view

(ASHA, (n.d). Dementia)

COMMON SYMPTOMS (CONT'D)

- o Language Deficits
 - Empty discourse with fewer ideas
 - Repetitious/perseverative language
 - o same question repetition
 - Word-finding difficulties
 - Tangential language
 - Circumlocution
 - Grammatical errors
 - o omissions/incorrect use of articles
 - o Prepositions
 - o auxiliary verbs
 - Loss of meaningful speech

(ASHA. (n.d.). Dementia)

COMMON SYMPTOMS (CONT'D)

- o Inability to follow conversations
- o In bilingual individuals:
 - Errors in selecting and maintaining appropriate language during conversation (Friedland & Miller, 1999).
 - Regression to primary language (Mendez, Perryman, Pontón, Cummings, 1990).
- o Language comprehension deficits
- o Difficulty following multi-step commands
- o Written language impairment
- o Reading comprehension issues

(ASHA. (n.d.). Dementia)

COMMON SYMPTOMS (CONT'D)

- o Social Cognition and Behavior Deficits
 - Inappropriate social behavior
 - Assimilation of nonverbal and soft cues errors
 - Loss of empathy
 - Aggressive behaviors
 - o Restlessness
 - o Fluctuations of mood
 - o Negative reactions to questioning
 - o Combativeness/hostility/aggressiveness
 - o Compulsive or obsessive behaviors
 - o Paranoia and delusions of persecution
 - Depression
 - o Loss of initiative/motivation

(ASHA. (n.d.). Dementia)

DIFFERENTIATING DEMENTIA FROM OTHER DISEASES

- o Delirium – “acute state of confusion” with “temporary, but reversible cognitive” deficits (Mahendra & Hopper, 2013).
- o Age related memory loss
 - Short term
- o Other conditions
 - Symptoms are inconsistent
 - Treatable
 - o Infections (e.g. meningitis, syphilis, urinary tract infection (UTI))
 - o Toxicity (e.g., exposure to toxic metal drug-induced dementia)
 - o Pseudo dementia from psychiatric disorders
 - o generalized anxiety disorder
 - o Mania
 - o Schizophrenia
 - o conversion disorder
 - o depression

(ASHA. (n.d.). Dementia)

Case History

CASE HISTORY: MEET KATHERINE

- o **78 year old** living in Assistive Living Center
- o **Diagnosis** of Lewy Body - **72 years**
- o **History:** honored educator, Assistant Principal, Principal, and Assistant Superintendent
- o Children described her as a multitasker, creative, intellectual mother.
 - **Now:** Dr. Jekyll and Mr. Hyde
- o **First symptom** of “something wasn’t right” when the siblings found wallpaper and border lining the refrigerator - **age 68**
- o **Before diagnosis:** Had an episode of aggressiveness, disoriented, etc. – admitted to Parthenon (psych ward).
 - After discharge, she asked her family if she was crazy. They said “no” and “why do you ask”? She said, “those people are crazy in there.”
- o **Medical history:**
 - Diabetic – steals food from residents now.
 - Recent fall, unsteadiness, and hyperacusis.
 - Saw an ENT, no hearing test, just ordered balance test.

- In the short period of several years, she has lost:
 - Socialization skills
 - ? Hearing - does have hyperacusis
 - Multitasking ability
 - No “drive” for life
 - Memory deteriorates daily
 - Ability to live independently
 - Zest for life
- Take Away:
 - Perspective from Katherine’s daughter, “No one deserves to have dementia.”
 - Family frustrated with lack of medical care or empathy.

Treatment goals, Interprofessional collaboration, Screening Tools, & Resources

TREATMENT GOALS AND PRIORITIES

- **Attentive Listening** is a must!
- **All-inclusive Case History**
 - Head injuries
 - Cognition (MCI)
 - Medical
 - Psychological
 - Medication (polypharmacology)
- Be cognizant to **aberrant** communication
 - Memory retrieval
 - Word finding difficulties
- **Customized** treatment plans and goals
- **Focus** on patient needs
 - Hearing
 - Cognition
 - Overall health
 - Independence
 - Coping strategies in adversity
 - Fall prevention
 - Social support system
 - Lifestyle changes

TREATMENT GOALS (CONT'D)

- Facilitate communication
 - Face to face – lip reading cues
 - Speak slowly
 - information in context
 - Speak clearly
 - No exaggerated speech
 - Speak in a lower pitched voice – comprehension
 - Note: hearing impaired individuals may “appear to follow the conversation”
 - Active engagement of patient – ensures information is received.

PROTOCOL FOR WORKING WITH ARHL AND DEMENTIA PATIENTS

- Patient Centered Approach –
 - Help patients become **advocates** for themselves
- Multidisciplinary involvement
 - Psychological/well-being referrals as needed
 - Audiologists, Speech-Language Pathologists, Physicians, Nurse Practitioners, Physician Assistants, Gerontologists, Cardiologists, Neuropsychologists, Endocrinologists, Psychiatrists, Psychologists, Social workers, Physical Therapists
- Communication therapy to include:
 - Utilizing nonverbal cues to enhance communication
 - Using visual strategies to increase memory
- Communication aids:
 - Amplifiers (low cost)
 - HAT/Assistive Listening Devices
 - Smartphone applications for aural rehab/brain games
 - Hearing aids/Cochlear Implants
 - Nametags for identification
 - Visual Aids
- Educate caregivers, and family members on communication skills and strategies to improve communication and reduce stress.
- Strive for **improvement in quality of life!**

ADDITIONAL TEST BATTERY

- Hearing Handicap Inventory in the Elderly Screening Questionnaire (HHIE-S) – assessment of patient’s hearing handicap
- Mini-Mental State Exam (MMSE) – assessment of mental status
- Mini-Cognitive Assessment Instrument (Mini-Cog) – assessment of cognitive status
- Montreal Cognitive Assessment (MoCA) – assessment of cognitive status

AUDITORY ASSESSMENT/AURAL REHABILITATION

- Hearing Handicap Inventory in the Elderly-Screening Questionnaire* (HHIE-S)
 - 10 closed ended (yes/no/sometimes) questions
 - 0-8 score – no handicap
 - 10-24 score – mild to moderate handicap
 - 26-40 score – severe handicap
 - Pre and post fitting easy questionnaire

*(Ventry, L, Weinstein, B., 1983)

MINI-MENTAL STATE EXAM (MMSE)

- Created by Folstein, M.F., Folstein, S.E., & McHugh, P.R. in 1975.
- Most commonly used test.
- Series of questions to assess everyday mental skills
- Maximum score is 30 points
- Interpretation:
 - 20-24 – mild dementia
 - 13-20 – moderate dementia
 - < 12 – severe dementia
- Note: Free download at Medworksmedia.com

APPLYING THE EVIDENCE

- History: A patient's family had concerns about memory difficulties.
- Test results:
 - Mini-Cog screening instrument: Recalled only 1/3 items
 - Most of the numbers were placed on right side of clock correctly
 - Clock hands incorrectly placed
 - Results: positive for dementia
 - Referral for full evaluation to include detailed interview, diagnosis confirmation, and secondary causes assessment.

TESTS FOR COGNITIVE DISORDERS

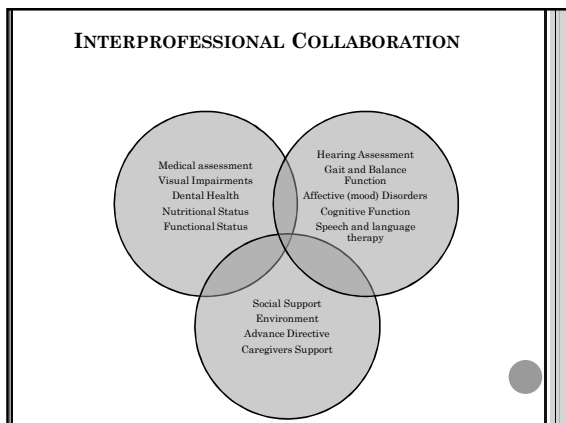
- Montreal Cognitive Assessment (MoCA) – 1996
 - Rapid screening
 - Administer time: 10 minutes
 - Mild cognitive impairments
 - 90% sensitivity rate; 87% specificity enabling a 90% identification of mild cognitive impairment (MCI); 100% Alzheimer's identification (Castiglione, et. al., 2016).
 - Assessments of:
 - Language
 - Visuoconstructional skills
 - Calculations
 - Orientation
 - Conceptual thinking
 - Memory

INTERPRETATION OF SCORES ON THE MOCA

- 26/30 and higher - normal (Castiglione et al., 2016)
- Below - abnormal

ADVICE FOR AUDIOLOGIST AND SLPs

- Simplify patient care
- Provide effective communication strategies
- Provide amplifiers when hearing aids aren't available [PSAP – personal sound amplification products to Pocket talkers].
- Comprehensive rehabilitation
- Speak face-to-face in quiet environment
- Be empathetic and caring
- Educate caregivers, nursing staff, and family on proper care of assistive devices and communication strategies.



CONNECTING THE DOTS BETWEEN HEARING LOSS AND DEMENTIA

Hearing Loss	Dementia
<ul style="list-style-type: none"> ○ Aging ○ Etiological pathway ○ HL leads to “cognitive load” on brain (garbled signal) ○ Atrophy of brain structures and function ○ Social isolation ○ Insidious condition ○ Polypharmacology 	<ul style="list-style-type: none"> ○ Aging ○ Etiological pathway ○ Cognitive overload ○ Decrement thinking and cognitive skills ○ Atrophy diminishes cognitive function ○ Social isolation is a risk factor for dementia and cognitive decline ○ Insidious condition ○ Polypharmacology

Blum, H. (2015)

CONTACT INFORMATION

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