Alzheimer’s Disease and Related Dementias: Pathophysiology, Oral Disease, and Exercise Physiology

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Learning Objectives

• Develop and disseminate information addressing health problems of geriatric patients, with specific focus on Alzheimer’s Disease (AD) and Related Dementias.

• Utilize an interprofessional approach to geriatric disease treatment and prevention with an open exchange of information and skill building from faculty and participants.

• Provide interprofessional training for faculty and providers who care for geriatric patients with a focus on team/patient bidirectional communication, prevention of co-morbidities and cultural sensitivity.

• Introduce and develop interprofessional team building skills using standardized patient teaching and simulation training.
AD & Related Dementias

• Mild Cognitive Impairment (MCI): may be prodromal stage of AD or another dementia
• Dementia with Lewy Bodies (including Parkinson’s Disease): neurodegenerative disease with clinical signs of dementia, visual hallucinations, & Parkinsonism
• Vascular Dementia & Vascular Cognitive Impairment: when cognitive dysfunction due to cerebrovascular disease such as stroke
• Frontotemporal Dementia: progressive neurodegenerative disorder with behavioral or speech clinical presentations
Alzheimer's Disease

• Defined: “Alzheimer’s disease is a neurodegenerative disease of the brain characterized by a clinical dementia with prominent memory impairment and specific microscopic pathology including senile plaques and neurofibrillary tangles”
Prevalence

• 5.3 million American’s of all ages have Alzheimer’s disease in 2015
• 5.1 million people are age 65 and older, with 200,000 under age 65
• 2/3 of American’s with Alzheimer’s disease are women
• By 2025, it is estimated that 7.1 million American’s age 65 and older will have AD

Alzheimer’s Disease Facts and Figures, 2015
Projected increases in AD

• The projected increases in AD rise sharply in 2030 as the baby boomer generation achieves age 65.
• The biggest increases in AD happened during ages 65-85 with a 2.5% incidence at age 65-70 years old and peaking at 50% in those over age 85.
• Average AD patient lives approximately 10 years from diagnosis to death (range 4-12 years)
Alzheimer’s Disease Pathology

• There are two main pathology features: senile plaques and neurofibrillar tangles.

• **Senile plaques** contain a specific type of amyloid, often referred to as β-amyloid or as “Aβ”. (This amyloid does not have anything to do with systemic amyloid or amyloidoses)

• Researchers believe these Aβ may cause the plaque damage in AD

• Certain areas of the brain are targeted resulting in the characteristic symptoms
AD Pathology - continued

• Neurofibrillary tangles
• Tangles are composed of hyperphosphorylated form of microtubule-associated protein Tau
• Tau is like the support beams or rivets in this microtubule system
• Tangles are like skeins of yarn; amount said to correlate with severity of AD

Alzheimer’s Disease

• Four Stages
• Begin with mild decline progressing to loss of ability to care for self, communicate or know others
• Progressive and usually average life span 10 years from diagnosis to death
• It is the prevalent cause of dementia in the elderly
Common Signs and Symptoms in AD

- Memory
- Language
- Visuospatial
- Reasoning & Judgment (executive function)
- Behavioral & Psychiatric Symptoms

- Source: Box 2.1 page 10, Budson & Solomon
AD Diagnostic Criteria

• DSM-IV and National Institutes of Neurological & Communicative Disorders (NINCDS-ADRDA)

• Key Elements are:
  – Dementia
  – Progressive decline in: memory and at least one other major area of cognition (language, executive function)
  – No disturbance of consciousness, such as delirium or acute confusional state
  – Decline in function cannot be explained by another medical or brain disease
Diagnosis – National Institute on Aging

• Core Clinical Criteria (5):
  – 1. Interfere with ability to function at work or usual activity
  – 2. Represent a decline from previous functioning or performing
  – 3. Not explained by delirium or major psychiatric disorder
  – 4. Cognitive impairment detected and DX through combination of (1) HX and (2) cognitive assess

McKhann, et al. (2011)
Diagnosis - continued

5. Cognitive or behavior impairment involves a minimum of two of the following domains:

1) Impaired ability to acquire and remember new information
2) Impaired reasoning & handling complex tasks
3) Impaired visuospatial abilities
4) Impaired language functions
5) Changes in personality, behavior, or component

McKhann, et al. (2011)
Common Signs, Symptoms, and Stages

<table>
<thead>
<tr>
<th>Prodromol</th>
<th>Mild AD</th>
<th>Moderate AD</th>
<th>Severe/late AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very mild cognitive decline</td>
<td>Memory loss</td>
<td>Increase memory loss</td>
<td>Inability to recognize family or to communicate</td>
</tr>
<tr>
<td>Memory lapses</td>
<td>Confusion about location or familiar places</td>
<td>Confusion</td>
<td>Lost sense of self</td>
</tr>
<tr>
<td>Poor word-finding</td>
<td>Taking longer to accomplish tasks</td>
<td>Problems recognizing friends/family</td>
<td>Weight loss</td>
</tr>
<tr>
<td>Decline in ability to plan and organize</td>
<td>Trouble handling $ or pay bills</td>
<td>Poor judgment lead to bad decisions</td>
<td>Groaning, moaning, grunting</td>
</tr>
<tr>
<td></td>
<td>Poor judgment lead to bad decisions</td>
<td>Difficulty organizing thoughts</td>
<td>Increased sleeping</td>
</tr>
<tr>
<td></td>
<td>Loss of spontaneity or sense of initiative</td>
<td>Inability to learn new things or coping</td>
<td>Loss of bladder/bowel control</td>
</tr>
<tr>
<td></td>
<td>Mood/personality changes, anxiety</td>
<td>Restlessness, agitation, anxiety, tearfulness, wandering</td>
<td>Seizures, skin infections, difficulty swallowing</td>
</tr>
<tr>
<td></td>
<td>Repetitive statements or movement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hallucinations, delusions, suspiciousness, paranoia</td>
<td></td>
<td>Aspiration pneumonia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Death</td>
</tr>
</tbody>
</table>

Treatment

- Cholinesterase inhibitors
  - This class of drugs improve memory and other aspects of cognition, improved function, and reduce behavioral and neuropsychiatric sx.
  - They should be established as soon as a diagnosis is established, and continued until the goal of treatment is only hospice. Ultimately the goal is the pt to die care, dignity and comfort.
Interprofessional Team Care

• The AD team should include medical and non-medical members:
  – Medical providers: physician, dentist, nurse practitioner, physician assistant
  – Nutritionist, physical therapist, geropsychiatrists, occupational therapist
  – Home health case managers
  – Elder-law attorneys, support services (transportation, home care aid)
  – Care giver support!
Oral Disease in Persons with AD and Related Dementia

- Why is oral health important?
- Common oral manifestations
  - Dental caries
  - Periodontal disease
- Oral Mucosa changes
- Salivary glands
Common Behavioral Oral-systemic Disease Risk Factors

- **Diet**
- **Smoking**
- **Stress/Control**
- **Alcohol**
- **Hygiene**
- **Physical inactivity**
Why is Oral Health Important?

Teeth are designed to last over the course of life!
- Loss due to disease
  - Dental caries -85% >65y/o
  - Periodontal Disease-98%>65y/o
- Disease does not remain localized

There is a strong link between oral disease and chronic diseases.
- Systemic disease
  - T-2-D
  - heart disease,
  - cognitive decline

“Oral health is essential to general health and well-being”

The U.S. Surgeon General
Periodontal and Gingival Tissues

Elderly have a higher plaque (thin sticky film of bacteria that adheres to the surface of teeth) score,

- Gingivitis
- Periodontitis

[Insert clinical image(s) of gingivitis and periodontitis]
## Classifications of Periodontal Disease

<table>
<thead>
<tr>
<th>Stages</th>
<th>Cause</th>
<th>Time interval</th>
<th>Brief histological depiction</th>
<th>Concise clinical description</th>
<th>Management options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gingivitis</td>
<td><strong>Systemic factors:</strong> Medication induced xerostomia, gingival enlargement, immune status, mouth breathing, <strong>Local factors:</strong> biofilm, plaque (gram-positive cocci and filaments), calculus deposits</td>
<td>4-7 days</td>
<td>Initial lesion, &gt; 14 days chronic lesion Local host response</td>
<td>Erythema, tissue edema, bleeding on probing/ manipulation</td>
<td>Reversible after meticulous oral hygiene, removal soft/hard deposits. Salivary substitutes: Oral balance Moi-Stir MouthKote XeroLube Sialogogues: Evoxac (Cevimeline) be aware Adverse side effects Caphosol artificial Saliva</td>
</tr>
</tbody>
</table>
| Advanced lesion transition to periodontitis | **Systemic factors:** Medications, xerostomia, physical/cognitive impairment, chronic illness, social habits, financial constraints, oral health literacy  
 **Local factors:** biofilm (gram-negative bacteria and spirochetes) expands into the subgingival space, calculus deposits, occlusion, tooth morphology/proximal contact, defective restorations, chronic advanced endodontic lesions | Local host response, > 14 days Distant host dependent response | Response to biofilm noxious substances cause chronic inflammatory elevated levels of monocytes; lymphocytes induce fibrotic response that has both local (CT breakdown and alveolar bone resorption) and systemic inflammatory manifestations. | Inflammation has extended to clinical loss of adjacent attachment, pocket depth 4-5 mm in moderate disease, advanced disease pocket depth >5 mm, evidence of alveolar bone loss. Evidence of furcation involvement, tooth mobility is associated with chronic inflammation. | Meticulous oral hygiene, with removal of supra/sub gingival soft/hard deposits, Non alcohol based Chlorhexidine gluconate 0.12% oral rinse (Peridex) Fluoride (Duraphat) varnish (Post periodontal surgery) Essential Oils (Listerine) Triclosan (Colgate Plax) |
Common Oral Manifestations

Dental caries

Modifiable risk factors
- diet dependent
- medication
- stress

Older adults
- Higher plaque score
- $4 \times$ more likely to have unrestored dental caries than children
AD and Oral Disease

• A number of studies have found that those who experienced tooth loss of *half or more* of their *natural dentition before 35 years* of age had a *1.7 greater risk* for Alzheimer’s disease.

• Evidence to support that IL-6, and other cytokines will cross the BBB

• In all these studies it was concluded that *oral disease is a risk factor* for Alzheimer’s
Other Manifestations of AD that Will Affect Oral Disease

• Xerostomia - medication induced
• Fever
• Malaise
• Dysgeusia (altered taste)
• Stomatitis – Candida
• Spasms of the muscles of mastication
• Tardive dyskinesia
• Hyposalivation
• Reduce appetite
• Decrease social contact
• Decline in IADL
• Lack of oral hygiene practice – Irritable/Combative
• Decline in self-care ADL - forget to remove prosthesis
Dementia and Associated Destructive Behaviors

• Behaviors are related to type and or stage of dementia
• Behavioral variability among individuals with dementia
• Behavioral variability within individual – may be consistent or some are triggered by events or variable occurrences
• Studies have shown in the United States 85% of resident become agitated and aggressive
  – Feeling of fear and confusion usually precede the behavioral problem
Three Main Behaviors that Occur in Adults with Dementia

• Alteration in activity (incontinence, bathing, dressing, grooming, sleeping, wandering, sun-downing, screaming, wanting to go home)

• Alterations in perception (hallucinations, paranoia)

• Aggression (anger, agitation, disruptive combative)
Intervention for the Prevention of Behavioral problems

• Decrease environmental stressors
  • Remove person from stressful situation
  • Allow time for response
  • Offer activities person is capable of managing
  • Use task breakdown
  • Keep a consistent routine and daily ritual

• Meeting primary self-needs
  • Ensure the person is comfortable
  • Look to persons lifestyle and preferences to ensure that person is not bored or frustrated
  • Do not force person to do activities

• Increase quality and quality of social interactions
  • Use verbal and non verbal communication
  • Use quiet conversation time to convey a message of safety, caring, and connection

• Balance inner retreat and active times
  • Respect and recognize persons need to display somnolent behavior or rhythmic behavior
  • Maintain a safe environment especially for wanderers
### Communication Strategies

<table>
<thead>
<tr>
<th>Verbal</th>
<th>Speech construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use short words and simple sentences</td>
<td></td>
</tr>
<tr>
<td>• Use nouns and not pronouns</td>
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</tr>
<tr>
<td>• Begin each conversation by indentifying yourself and using the person’s name/title</td>
<td></td>
</tr>
<tr>
<td>• Avoid complex questions</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Speech style</th>
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<tbody>
<tr>
<td>• Speak slowly, clearly and in lower voice tone</td>
</tr>
<tr>
<td>• Wait for a response to a question and ask one question at a time</td>
</tr>
<tr>
<td>• Repeat questions exactly if necessary</td>
</tr>
<tr>
<td>• Use normal voice</td>
</tr>
<tr>
<td>• Never talk as though the person is not there</td>
</tr>
<tr>
<td>• Always assume that the person understands more than he/she may be able to express</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-verbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Stand in front of/side of the person in his/her line of vision</td>
</tr>
<tr>
<td>• Maintain eye contact</td>
</tr>
<tr>
<td>• Move slowly and calmly</td>
</tr>
<tr>
<td>• Smile and use a gentle touch</td>
</tr>
<tr>
<td>• Provide caring and nurturing cues</td>
</tr>
<tr>
<td>• Allow the person to have rest periods</td>
</tr>
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<table>
<thead>
<tr>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Presence of caregiver is helpful</td>
</tr>
<tr>
<td>• Break down activities into steps</td>
</tr>
<tr>
<td>• Present one idea at a time</td>
</tr>
<tr>
<td>• Use praise and positive reinforcement</td>
</tr>
<tr>
<td>• Decrease the number of people in the room</td>
</tr>
<tr>
<td>• Explain procedures before performing them</td>
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</tbody>
</table>
# Communication Methods to Manage Oral Disease in Persons with Dementia

<table>
<thead>
<tr>
<th>Method</th>
<th>Action</th>
<th>Dental example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaining</td>
<td>The person/care-provider (CP) starts the activity and person with dementia/resident completes it.</td>
<td>Care-provider (CP) places the toothpaste on the toothbrush and places it in the person with dementia/resident hands and then the resident brushes his/her teeth.</td>
</tr>
<tr>
<td>Hand-over hand</td>
<td>The CP hand is placed over the residents hand to guide the resident through the activity.</td>
<td>The dentist places lower denture in the residents hand then places his/her hand over the residents to guide the lower denture back in the mouth.</td>
</tr>
<tr>
<td>Bridging</td>
<td>To improve sensory connection and task focus by having the resident hold the same object as the CP while the provider carries out activity.</td>
<td>The resident holds a toothbrush while the dentist uses a backward bent toothbrush to assist in breaking peri-oral muscle spasm to gain access to oral cavity.</td>
</tr>
<tr>
<td>Distraction</td>
<td>The use of singing, music, holding items gentle touch, and talking to distract the resident from a distressing situation.</td>
<td>A rummage box or busy apron/cushion/board (with a familiar theme) is used to occupy the active hands of a resident during the examination.</td>
</tr>
<tr>
<td>Typical age-related change</td>
<td>Signs of Alzheimers/dementia</td>
<td></td>
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<tr>
<td>--------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Making a bad decision once in a while</td>
<td>Poor judgment and decision making</td>
<td></td>
</tr>
<tr>
<td>Missing a monthly payment</td>
<td>Inability to manage a budget</td>
<td></td>
</tr>
<tr>
<td>Forgetting which day it is and remembering later</td>
<td>Losing track of the date or the season</td>
<td></td>
</tr>
<tr>
<td>Sometimes forgetting which word to use</td>
<td>Difficulty having a conversation</td>
<td></td>
</tr>
<tr>
<td>Losing things from time to time</td>
<td>Misplacing things and being unable to retrace steps to find them</td>
<td></td>
</tr>
</tbody>
</table>
Health is shaped by an interaction of biological, physiological, behavioral, and environmental factors that unfold over the course of life.
Challenges of Safe Exercise

• Recommend that patients see a physical therapist for initial evaluation and instruction in exercise program (2-3 visits plus 1-2 F/U visits over time)

• Many older adults have musculoskeletal problems and other co-morbidities that mean that the exercise prescription would have to be tailored to each individual patient as much as possible

• Precaution: Acute cardiac events significantly associated with episodic physical activity so must progress vigor of activity slowly (Dahabreh & Paulus, 2011)
Aerobic Exercise and AD

- What has aerobic exercise been shown to accomplish for patients with AD?
  - Decrease the risk of developing AD (Budson & Solomon, 2011)
  - Enhance memory (Scarmeas et al., 2009a)
  - Slow memory loss (Budson & Solomon, 2011)
  - Enhance cognitive function (Weuve et al., 2004)
How Are These Benefits Achieved?

• Several studies using rats have shown that aerobic exercise results in new brain cells developing in the hippocampus (Galvan & Bredesen, 2007)
What is the Role of the Hippocampus?

• Part of the limbic system
• Assists in the consolidation of information from short-term memory to long-term memory and also spatial navigation (Wikipedia)
• Hence the early symptoms of loss of memory & disorientation in AD
Physiologic Basis of Other Benefits of Aerobic Exercise for AD

- Can increase brain volume (Colcombe et al., 2006; 2008; Galvan & Bredesen, 2007)
- Can improve cognitive function (Weuve et al., 2004)
How Much Aerobic Exercise?

• The rat studies have shown a direct relationship between the amount of aerobic exercise and the development of new cells in the hippocampus (Galvan & Bredesen, 2007)

• “Some exercise is good, and more exercise is better.” (Budson & Solomon, 2011, p 218)

• Follow the guidelines for diabetes management and the precautions
Cost and Payment for Health Care

• Most geriatric patients enrolled in Medicare have significant out of pocket expenses related to outpatient care and dental services.
• Outpatient physician providers = 15% cost covered by patient.
• Dental care = 76% covered by patient.
• Physical therapy outpatient costs = approximately 19%.
Retirement Income

• Median income for age 65 and older in 2010 = $25,757 (Social Security Administration)
• The poverty rate for people age 65 and over was 8.7%
• Average spend 12-14% of their income on healthcare or $3,090 - $3,605
Cost of Care

- $212/day or $77,380/year for semi-private room in a nursing home
- $240/day or $87,600/year in a private nursing home
- $3,500/month or $42,000/year for basic services in assisted living
- $20/hour for home health aide
- $65/day for adult day services

Alzheimer’s Association, 2010
AD Costs

• Average annual costs of care (direct/informal) for people aged 70+ in U.S. in 2010 was $157 to $210 billion

• Average cost per dementia case in 2010 was between $41,000 and $56,000

• AARP article illustrated one family costs between $84,000-$108,000/year costs for assisted living and locked memory care unit – all not covered by Medicare

AARP, 2013; Alzheimer’s Association, 2010
Netherlands Community

- Village built exclusively for people with dementia
- The Hogewey Village
  - [https://www.youtube.com/watch?v=LwiOBlyWpko](https://www.youtube.com/watch?v=LwiOBlyWpko)
Hogewey Village

- BBC Video
- https://www.youtube.com/watch?v=bnmdrtxJxX0
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