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Dementia and the Role of Alzheimer Disease

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Introduction

Dementia is a progressive disease in which deterioration of the cerebrum causes a disruption in intellect and behavior (McCance & Huether, 2019, p. 520). The incidence of dementia increases with age (Larson, 2019, p. 1). According to the World Health Organization (WHO), it affects about "50 million people" worldwide with close to "10 million new cases each year" (WHO, 2019). The diagnosis of dementia is very common in hospital and outpatient settings. The most common cause is Alzheimer disease (AD) consisting of "60% to 80%" of all cases (Larson, 2019, p. 3).

It is a debilitating disease and has detrimental effects on the patients, caregivers, and family. As an emergency department nurse and a grand-daughter of a patient struggling with dementia, this has become a topic of interest.

Signs & Symptoms

Clinical presentation is a gradual onset and involves impairment in cognition, language, and functional ability.

- Forgetfulness: chief complaint
- Difficulty retaining new information
- Unable to complete complex tasks
- Trouble with reasoning
- Disorientation, poor spatial ability
- Language impairment
- Behavioral disturbances (Larson, 2019, p. 4-5)

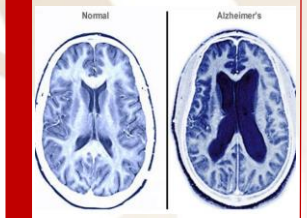

Figure 1. Retrieved from http://images.medicinenet.com/images/slideshow/alzheimers-s6-alzheimer-brain-scans.jpg

Underlying Pathophysiology

- Causes of dementia are: infection (encephalitis, meningitis, neurosyphilis), normal pressure hydrocephalus, chronic subdural hematoma, nutritional deficiencies, chronic drug or alcohol use, metabolic disorders (thyroid abnormalities, hepatic encephalopathy, cerebral vasculitis, sarcoidosis), tumors, medication effects (anticholinergics, antihypertensives, antihistamines), neurodegenerative disorders (Alzheimer disease, dementia with Lewy bodies, Frontotemporal dementia, Pick disease, Huntington disease, Parkinson disease), vascular disease (vascular dementia, multi-infarct, strategic single infarct, Binswanger disease, Amyloid angiopathy), irreversible infections (Creutzfeldt-Jacob disease, Postencephalitic dementia, HIV) (McCance & Huether, 2019, p. 521).
- Research is still underway to find a cause for Alzheimer disease, three genes on chromosome 21 have been found to play a role in early onset familial AD and chromosome 19 has been linked in late onset AD (McCance & Huether, 2019, p. 521). The gene mutations interrupt the brain's ability to get rid of beta-amyloid proteins, which then leads to neurofibrillary plaque and tangle development that kills neurons.
- Both the innate and adaptive inflammatory processes have been found to have implications in AD progression. Microglia and astrocytes are normally protective and regulatory cells of the brain, however, when beta-amyloid and tau protein accumulate, cytokines (i.e. tumor necrosis factor) are released and neurons are destroyed (Eldik, et al, 2016, p. 100-102).
- The blood brain barrier (BBB) plays a part in allowing the influx of leukocytes when it is damaged by tau and beta-amyloid proteins. BBB disruption near the hippocampus, which is somewhat normal with aging, occurs at a faster rate with AD, and the damage to the area around the hippocampus translates to memory and language deficits (Zenaro, Piacentino, & Constatin, 2017, p. 42).
- Inflammatory markers of major histocompatibility complex (MHC) class II, cyclooxygenase (COX-2), monocyte chemoattractant/chemotactic protein (MCP-1), tumor necrosis factor alpha (TNF-a), interleukin beta (IL-b), or IL-16 can be found near senile plaques that are surrounded by microglia and astrocytes (Hohsfield & Humpel, 2015, p. 10).
- The "neuropathological hallmarks of AD are neuronal degeneration, loss of synapses, neurofibrillary tangles, gliosis, and amyloid-beta accumulation in senile plaques" (Zenaro, Piacentino & Constatin, 2017, p. 42). There is also a loss of acetylcholine related to damage to cholinergic neurons (McCance & Huether, 2019, p. 521).
- Arteriosclerosis and atherosclerosis can lead to infarcts in the brain. A correlation between beta-amyloid deposits and decrease in blood flow has been discovered and has been theorized to cause cognitive dysfunction as well as possibly worsen AD. Because diabetes mellitus type II and insulin resistance are linked to vascular disease, they are risk factors for dementia as well. The immune system is attributed to inflammation around plaques and tangles and impairment of the blood brain barrier that lead to neurological damage linked to dementia. The blood brain barrier may also be disrupted by alterations in lipid transport; APOE is involved lipid transport and if APOE4 is present, that can indicate a genetic precursor for AD. Another factor is lack of collateral circulation in the cerebral pia during a cerebral vascular accident that limits the access of back up blood flow (Snyder et al, 2015 p. 2-4).

Significance of Pathophysiology

Reversible forms of dementia should be ruled out and treated before a diagnosis of Alzheimer's disease is confirmed. More research is needed to determine how to slow down the inflammatory process and stop the deposits of beta-amyloid and tau proteins from forming. Lifestyle modifications to reduce the risk of vascular disease are important. Prevention and proper management of arteriosclerosis, atherosclerosis, and diabetes could reduce the risk for developing dementia.

Age is considered the greatest contributing factor to dementia, but despite that, misconceptions exist that cognitive deficits are a normal part of aging (Stewart et al., 2014, p. 276). Diagnosis is commonly made when a person is already moderately to severely affected by the disease, but early cognitive testing is an important aspect in diagnosis of dementia and might be beneficial if conducted prior to onset of obvious signs of impairment. Symptom management is crucial to try to preserve the patient's quality of life, especially because no curative treatment is available.

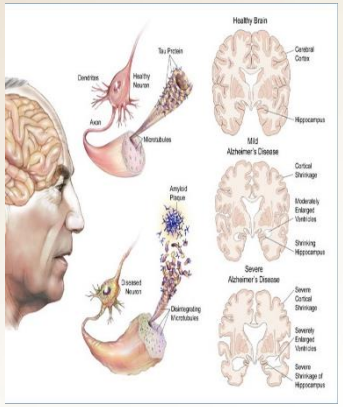

Figure 2. Retrieved from https://mappingignorance.org/fx/media/2014/10/Image1.jpg

Figure 3. World Health Organization, 2019.

Case Study

A 70-year-old female presents to her primary care provider with complaints of disorientation (especially at night), forgetfulness, and difficulty completing activities of daily living. The diagnosis of dementia is established after a thorough history and physical are completed as well as the Mini-Mental Status Exam, and other potential causes are ruled out with diagnostic blood work and imaging of the brain. Other signs and symptoms might include "a serious loss of at least 2 cognitive functions, such as memory, attention, thinking, or language" (Stewart, et al, 2014, p. 275).

The patient is started on memantine to help slow down the progression of dementia. In a systematic review by Buckley and Salpeter (2015) found that cholinesterase inhibitors have minimal benefit and are cautioned related to the side effects and memantine proved also to have minimal benefit but less side effects (p. 462). An anti-depressant medication is also added to manage neuropsychiatric symptoms. Serotonin reuptake inhibitors, especially citalopram, have been helpful for agitation and paranoia (Press & Alexander, 2018). The primary health care provider enlists multi-disciplinary approach including nursing, pharmacy, physical/occupational therapy, dietary, and case management.

Nursing Implications

- Nursing must consider the nonpharmacological approaches for dementia care, such as exercise and cognitive therapy.
- Patient safety should be constantly assessed, and the environment modified as needed.
- Education is very important for all the primary caregivers. Dementia disease process and treatment options should be discussed with the patient and family.
- Encouragement of proper nutrition, sleep, elimination and management of chronic diseases, such as hypertension, diabetes, heart disease, etc. with medication compliance is an important part of care and may slow disease progression.
- Watching for side effects of treatment as well as changes in behavior and worsening cognitive function are essential parts of the assessment.
- The patient should be encouraged to perform or participate in all activities of daily living with a goal of maintaining independence for as long as possible.
- Advance directives and goals of care should be discussed with the patient and family.

Conclusion

Alzheimer disease is a progressive disease causing cognitive and functional decline with the hallmark sign of plagues and tangles within the brain. Genetics, inflammation, accumulation of beta-amyloid protein and breakdown of the blood brain barrier are all contributing factors in the disease. Treatment is not curative and is focused on symptom management and management of pre-existing chronic diseases.

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