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FOCUSING ON DEMENTIA: A DISEASE WITH LOSS OF EMOTIONAL AND COGNITIVE ABILITIES

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ABSTRACT

Dementia is a disease of the brain characterized by the progressive loss of cognitive functioning, with memory and thinking impairments, personality changes, and the loss of emotional abilities. Dementia is not a normal part of the ageing process, and the loss of cognitive functioning is severe to the extent that it interferes with daily life. There are several forms of the disease, with Alzheimer's disease (AD), an inflammatory disorder, accounting for most cases. Loss of cognitive and emotional abilities are the striking features of dementia, and these factors combine to produce personality changes that progress to the point that the dementia patient is often unrecognizable as their former self. Symptoms include memory loss, changes in personality, spatial and temporal disorientation, impaired reasoning and judgement, social withdrawal, and difficulty in planning, problem solving, speaking, writing, and performing familiar tasks. Dementia is a major source of morbidity, mortality, and disability, and comes with high economic and societal costs. There is no cure for this disease at the moment, and treatment options are limited. Diagnosis is a multifaceted process that is difficult and expensive, yet early diagnosis is extremely important.

KEYWORDS: *dementia, cognition, behavior, BPSD, neuropsychiatric symptom, neurology, neurodegeneration, brain*

INTRODUCTION

Dementia is the loss of cognitive functioning, with impairments that affect the ability to think, remember, and make decisions, to the extent that it interferes with daily life. Although it usually affects older adults, dementia is not a normal part of the ageing process. The process of the disease progressively damages nerve cells, interfering with normal neural communication, with effects on cognition, behavior, and feelings.

Over the years, improvements in life longevity and population ageing have resulted in the growing incidence of dementia. According to recent estimates, the global number of people suffering with the disease increased by 117% between the years 1990 and 2016 (1), and this number is predicted to increase drastically in coming years (2,3).

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Symptoms that characterize dementia include memory loss that interferes with daily life, changes in personality, spatial and temporal disorientation, impaired reasoning and judgement, social withdrawal, and difficulty in planning, problem-solving, speaking, writing, and performing familiar tasks.

Dementia can take several different forms, including vascular, early-onset, and Lewy Body dementias, although the most prevalent is Alzheimer's disease (AD), which, according to the Alzheimer's Association, afflicts 1 of 9 Americans aged 65 and older (4). The World Health Organization estimates that AD may contribute to 60-70% of dementia cases (5). Additionally, young onset dementia, occurring before the age of 65, may have a prevalence rate of up to 9% of dementia cases (5) and this form can be familial (6). The disease causes morbidity, mortality, and disability and comes with high economic and societal costs.

Currently, there is no cure for dementia, and therapeutic options to slow progression are limited. Symptoms generally become progressively worse over the course of the disease, although some can occur exclusively in the later stages and others may disappear at that point. Demands on family and caretakers increase with disease progression, and as sufferers continue to lose the ability of memory, they may cease to be able to recognize their own family members and friends. There are increasing problems with motor control and diminishing ability to perform daily activities, and behavioral problems such as aggression, all of which cause distress for the person suffering with dementia and additionally, the caretakers and family members who are supporting them.

Dementia can be caused by different diseases, resulting from the loss of neuronal cells and damage to the brain, above and beyond the level of deterioration that occurs with normal biological ageing (5).

AD is the leading cause of dementia, accounting for 60-70% of cases (5). In AD, there is neuronal atrophy and loss of synapses throughout the cerebral cortex, however the etiology is still unknown. The characterizing hallmarks of the disease include the formation of amyloid-β plaques and neurofibrillary tau tangles, with associated neuroinflammation (Fig.1).

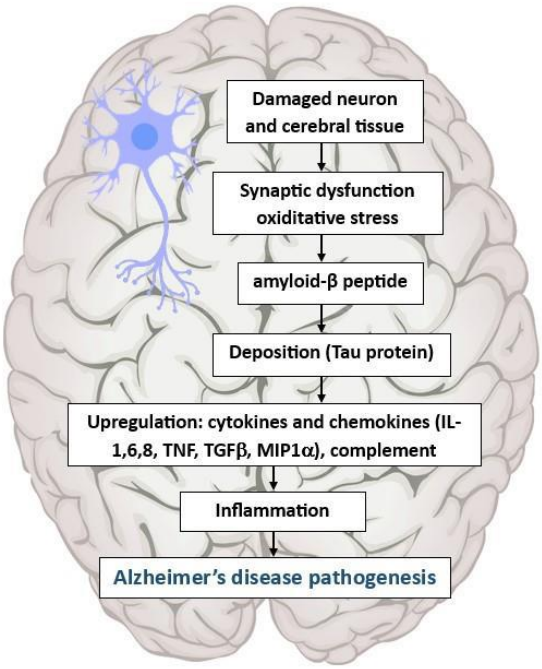

Fig. 1. *Markers of Alzheimer's disease (AD) pathogenesis.*

The predominant theory of AD considers the accumulation, deposition, and ineffective clearance of amyloid-β as central to the development of the disease (7,8). Amyloid-β is phagocytized by microglia and astrocytes which stimulates inflammatory cytokines, leading to neurotoxicity and provoking AD (Fig.2). Growing evidence continues to suggest that these protein aggregates result from a complex interaction of factors.

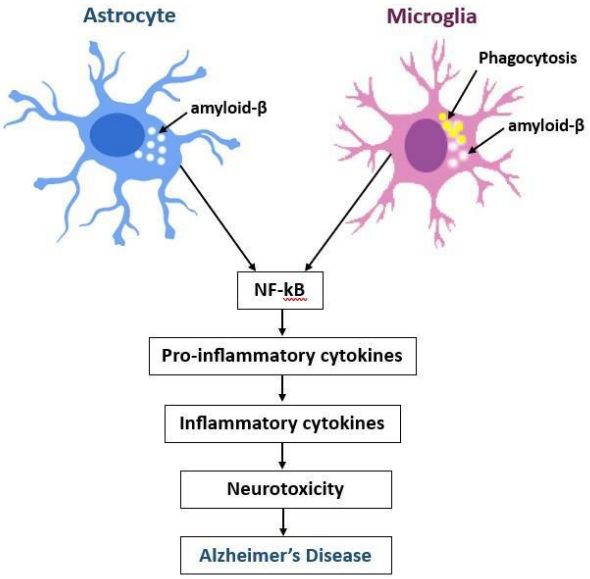

Fig. 2. *Here, we show that astrocytes and microglia affected by amyloid-β generate inflammatory cytokines, which provoke neurotoxicity in Alzheimer's disease (AD).*

In particular, the misfolding, aggregation, and accumulation of proteins is a characteristic event of neurodegenerative diseases, resulting in cellular dysfunction, loss of synaptic connections, and brain damage, and seems to play a role in AD and other forms of dementia (9). Diverse studies have shown that this process is at the base of neurodegenerative pathology, with proteins such as amyloid-β, tau, alpha-synuclein (α-Syn), and TAR DNA-binding protein 43 (TDP-43) implicated in different forms of dementia (10-12).

Recent evidence has shown that protein aggregates can self-propagate their pathological properties utilizing prion transmission with the seeding of protein misfolding, unveiling a new mechanism for the development and progression of neurodegenerative diseases such as dementia (12-14).

The behavioral and cognitive changes of dementia are considered separately, as independent dimensions, although they do influence one another (15). The loss of cognitive and emotional abilities combines to produce profound personality changes along the course of the disease, and in the later stages, the patient is often described by those who know them as being a completely different person, unidentifiable as their former self.

Loss of cognitive abilities

Cognitive impairment increases with the progression of dementia, compromising social, occupational, and daily functioning. The affected domains of cognition include learning, language, memory, executive function, complex attention, perceptual-motor, and social cognition (16). Declines in these domains have significant effects on the independence and performance of daily activities for patients, who often fail to fully realize or acknowledge these cognitive impairments, an occurrence that presents in the early stages of the disease and continues to worsen into the later stages (17).

The level of impairment that precedes dementia is mild cognitive impairment and it presents subtle changes that do not affect an individual's daily functioning. This type of mild deficiency in cognition can be a precursor to dementia, a normal process of ageing, or can arise as a symptom of a treatable, reversible condition, such as depression or acute illness.

Advancing toward moderate cognitive impairment, deficits become more pronounced and widespread, with increasing functional disability that can be seen by the inability to perform more complex tasks. By the later stages of the disease, most cognitive abilities are severely impaired and there is a loss of most normal functioning. Behavioral changes are also frequently observed at the late stages, including aggression, apathy, depression, and agitation (18).

The most prominent cognitive deficit for most varieties of dementia is memory loss, which is often vague. Typically, pronounced deficits concern the areas of new learning and memory recall. Patients have trouble carrying out tasks involving language, executive functions, semantic memory, and visuospatial/constructional skills. AD patients typically have trouble with rapid forgetting and the creation of false or distorted memories (19). Memory impairments in dementia are associated with structural or functional brain integrity, with the disease affecting the structure of neural networks and the formation of memories (20). Memory deficits can be noticed as the first symptoms of dementia, with

the observation of patients' tendencies to repeat themselves, forget quickly, or misplace objects, and may continue to be the dominant symptoms as time, and the disease, progresses.

Social cognition refers to the set of cognitive processes underlying social interactions, such as the effective recognition and use of social cues, the perception of self and others, and knowledge of interpersonal and social norms (21), and is frequently affected and manifested by confusing, abnormal behavior of dementia patients (22).

Dementia types can involve varied categories of cognitive impairment (23). In dementia with Lewy bodies, initial symptoms can involve visuospatial defects, hallucinations, and problems with attention and working memory capacity. Early symptoms in frontotemporal dementia (FTD) are often behavioral or affect social cognition, while those in temporal subtypes can affect language skills. Furthermore, initial symptoms of vascular dementia involve deficits in episodic memory, semantic knowledge, and executive, attention and visuospatial functions (24).

Anosognosia, a condition distinguished by the lack of awareness of a patient's own neurological deficit, is a main behavioral feature of FTD, and patients are often unable to recognize their declining cognitive state (25). However, AD patients show a higher level of recognition of their deficits compared to those with FTD with a relatively similar level of cognitive impairment (26).

Loss of emotional abilities and personality changes

Often, the most painful and difficult aspect of dementia, which affects the patients themselves and additionally, caregivers, is the drastic change in subjective experience and the awareness of self, others, and the external environment that develops with the disease (27). In advanced stages of dementia, the patient changes to such an extent that they are no longer recognizable as the person they once were before the disease, and this comes with great grief and feelings of loss for caretakers.

Emotional abilities are impacted by dementia, with changes in emotional responses and a loss of control over feelings and the ways in which to express them. Some common changes in emotion include irritability, overreaction, rapid changes in mood, and distant or uninterested demeanor.

There is a decline in emotional control and responses, along with changes in social behavior. Those with dementia have trouble communicating their feelings with others and experience difficulty in the social domain regarding empathy and the exchange and processing of shared emotions that is based on the incapacity to apprehend the emotional states of other people (28,29). In particular, FTD is noted for a "decline in social interpersonal conduct" and semantic dementia (SD) is marked by the "loss of sympathy and empathy" (30). Over the course of FTD, there is a gradual degeneration of social dexterity accompanied by diminished self-awareness, and individuals with this disease become socially disinhibited, apathetic, cold, often with notable changes in personality (31-33); new hobbies, aesthetic preferences, or personal views and beliefs may develop that deviate from those before dementia (34).

Self-conscious emotions, such as embarrassment, shame, guilt, and pride, which require a basis of the self in respect to social context, are strongly impaired and this can help to explain the seemingly strange social behavior of those suffering with dementia (35).

Dementia is often accompanied by severe behavioral and psychological symptoms that are non-cognitive. Behavioral and psychological symptoms of dementia (BPSD), the neuropsychiatric symptoms, may affect up to 90% of patients and often occur simultaneously. BPSD can predict poorer outcomes for patients and their caretakers, with increased levels of distress, long-term hospitalization, and overall healthcare costs (36). BPSD includes a wide range of symptoms such as agitation, apathy, depression, psychosis, aggression, and sleep problems. Neurobiological, psychological, and social aspects are all believed to contribute as causes of BPSD symptoms (37).

CONCLUSIONS

Diagnosis of dementia can be challenging, as the initial symptoms can be shared by a number of other conditions, some of which are reversible. These can include thyroid problems, vitamin deficiencies, dehydration and malnutrition, depression, and sensory impairments.

The multifaceted process of diagnosing dementia is difficult and expensive, and can involve the use of cognitive tests, brain scans such as magnetic resonance imaging (MRI) or positron emission tomography (PET), or lumbar puncture to verify the presence of amyloid-β plaques which are present in AD and some other forms of dementia. Early diagnosis is important, but obstacles such as expensive costs and unavailability in certain regions prevent options and availability to all persons. Furthermore, lack of awareness and understanding of dementia can create stigmatization and interfere with proper diagnosis and care (5).

Some medications can help manage the symptoms of this disease. These include antidepressants, anti-anxiety medications and antipsychotics. However, there may often be habituation of the medication or concerning side effects.

To date, there is no cure for dementia and there is no way to slow or stop the progression of the disease, but research is continuing, with the goal of improving diagnosis and treatment. This is of paramount importance since the worldwide prevalence of dementia will only continue to increase in the future, as improvements in health care will continue to expand life longevity and the ageing population will continue to increase.

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Nichols E, Szoeke CEI, Vollset SE, et al. Global, regional, and national burden of Alzheimer's disease and other dementias, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*. 2019;18(1):88-106. doi:https://doi.org/10.1016/s1474-4422(18)30403-4
2. Prince MJ. World Alzheimer Report 2015: The Global Impact of Dementia | Alzheimer's Disease International. Alz.co.uk. Published 2015. https://www.alz.co.uk/research/world-report-2015
3. Larson EB, Yaffe K, Langa KM. New Insights into the Dementia Epidemic. *New England Journal of Medicine*. 2013;369(24):2275-2277. doi:https://doi.org/10.1056/nejmp1311405
4. Alzheimer's Association. 2023 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*. 2023;19(4). doi:https://doi.org/10.1002/alz.13016
5. World Health Organization. Dementia. World Health Organization. Published March 15, 2023. https://www.who.int/news-room/fact-sheets/detail/dementia
6. Mendez MF. Early-onset alzheimer disease and its variants. *CONTINUUM: Lifelong Learning in Neurology*. 2019;25(1):34-51. doi:https://doi.org/10.1212/con.0000000000000687
7. Hardy J, Selkoe DJ. The amyloid hypothesis of Alzheimer's disease: progress and problems on the road to therapeutics. *Science (New York, NY)*. 2002;297(5580):353-356. doi:https://doi.org/10.1126/science.1072994
8. Zuroff L, Daley D, Black KL, Koronyo-Hamaoui M. Clearance of cerebral Aβ in Alzheimer's disease: reassessing the role of microglia and monocytes. *Cellular and Molecular Life Sciences*. 2017;74(12):2167-2201. doi:https://doi.org/10.1007/s00018-017-2463-7
9. Soto C, Pritzkow S. Protein misfolding, aggregation, and conformational strains in neurodegenerative diseases. *Nature Neuroscience*. 2018;21(10):1332-1340. doi:https://doi.org/10.1038/s41593-018-0235-9
10. Ross CA, Poirier MA. Protein aggregation and neurodegenerative disease. *Nature Medicine*. 2004;10(S7):S10-S17. doi:https://doi.org/10.1038/nm1066
11. Soto C. Unfolding the role of protein misfolding in neurodegenerative diseases. *Nature Reviews Neuroscience*. 2003;4(1):49-60. doi:https://doi.org/10.1038/nrn1007
12. Goedert M. NEURODEGENERATION. Alzheimer's and Parkinson's diseases: The prion concept in relation to assembled Aβ, tau, and α-synuclein. *Science (New York, NY)*. 2015;349(6248):1255555. doi:https://doi.org/10.1126/science.1255555
13. Soto C. Transmissible proteins: expanding the prion heresy. *Cell*. 2012;149(5):968-977. doi:https://doi.org/10.1016/j.cell.2012.05.007
14. Stopschinski BE, Diamond MI. The prion model for progression and diversity of neurodegenerative diseases. *The Lancet Neurology*. 2017;16(4):323-332. doi:https://doi.org/10.1016/S1474-4422(17)30037-6
15. Spalletta G, Baldinetti F, Buccione I, et al. Cognition and behaviour are independent and heterogeneous dimensions in Alzheimer?s disease. *Journal of Neurology*. 2004;251(6). doi:https://doi.org/10.1007/s00415-004-0403-6
16. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), American Psychiatric Association, 2013.

17. Okonkwo OC, Spitznagel MB, Alosco ML, Tremont G. Associations among measures of awareness of cognitive deficits in dementia. *Alzheimer's & Dementia*. 2010;6(4):312-318. doi:https://doi.org/10.1016/j.jalz.2009.06.005
18. Förstl H, Kurz A. Clinical features of Alzheimer's disease. *European Archives of Psychiatry and Clinical Neuroscience*. 1999;249(6):288-290. doi:https://doi.org/10.1007/s004060050101
19. Rabinovici GD. Late-onset Alzheimer Disease. *CONTINUUM: Lifelong Learning in Neurology*. 2019;25(1):14-33. doi:https://doi.org/10.1212/con.0000000000000700
20. Jahn H. Memory loss in Alzheimer's disease. *Memory*. 2013;15(4):445-454. doi:https://doi.org/10.31887/dcns.2013.15.4/hjahn
21. Beer JS, Ochsner KN. Social cognition: A multi level analysis. *Brain Research*. 2006;1079(1):98-105. doi:https://doi.org/10.1016/j.brainres.2006.01.002
22. Setién-Suero E, Murillo-García N, Sevilla-Ramos M, Abreu-Fernández G, Pozueta A, Ayesa-Arriola R. Exploring the Relationship Between Deficits in Social Cognition and Neurodegenerative Dementia: A Systematic Review. *Frontiers in Aging Neuroscience*. 2022;14. doi:https://doi.org/10.3389/fnagi.2022.778093
23. Baratono S, Press D. What Are the Key Diagnostic Cognitive Impairment and Dementia Subtypes and How to Integrate all of the Diagnostic Data to Establish a Diagnosis? *Clinics in Geriatric Medicine*. 2023;39(1):77-90. doi:https://doi.org/10.1016/j.cger.2022.08.002
24. Bahar-Fuchs A, Clare L, Woods B. Cognitive training and cognitive rehabilitation for persons with mild to moderate dementia of the Alzheimer's or vascular type: a review. *Alzheimer's Research & Therapy*. 2013;5(4):35. doi:https://doi.org/10.1186/alzrt189
25. Williamson CE, Alcantar O, Rothlind JC, Cahn-Weiner DA, Miller BL, Rosen HJ. Standardised measurement of self-awareness deficits in FTD and AD. *J Neurol Neurosurg Psychiatry*. 2010;81(2):140-145. doi:https://doi.org/10.1136/jnnp.2008.166041
26. Scherling CS, Zakrzewski J, Datta S, et al. Mistakes, Too Few to Mention? Impaired Self-conscious Emotional Processing of Errors in the Behavioral Variant of Frontotemporal Dementia. *Frontiers in Behavioral Neuroscience*. 2017;11. doi:https://doi.org/10.3389/fnbeh.2017.00189
27. Rice H, Howard R, Huntley J. Professional caregivers' knowledge, beliefs and attitudes about awareness in advanced dementia: a systematic review of qualitative studies. *International Psychogeriatrics*. 2019;31(11):1599-1609. doi:https://doi.org/10.1017/s1041610218002272
28. McLellan T, Johnston L, Dalrymple-Alford J, Porter R. The recognition of facial expressions of emotion in Alzheimer's disease: a review of findings. *Acta Neuropsychiatrica*. 2008;20(5):236-250. doi:https://doi.org/10.1111/j.1601-5215.2008.00315.x
29. Weiss EM, Kohler CG, Vonbank J, et al. Impairment in Emotion Recognition Abilities in Patients With Mild Cognitive Impairment, Early and Moderate Alzheimer Disease Compared With Healthy Comparison Subjects. *The American Journal of Geriatric Psychiatry*. 2008;16(12):974-980. doi:https://doi.org/10.1097/jgp.0b013e318186bd53
30. Neary D, Snowden JS, Gustafson L, et al. Frontotemporal lobar degeneration: a consensus on clinical diagnostic criteria. *Neurology*. 1998;51(6):1546-1554. doi:https://doi.org/10.1212/wnl.51.6.1546
31. Mendez MF. Functional neuroimaging and presenting psychiatric features in frontotemporal dementia. *Journal of Neurology, Neurosurgery & Psychiatry*. 2006;77(1):4-7. doi:https://doi.org/10.1136/jnnp.2005.072496
32. Rankin KP, Kramer JH, Mychack P, Miller BL. Double dissociation of social functioning in frontotemporal dementia. *Neurology*. 2003;60(2):266-271. doi:https://doi.org/10.1212/01.wnl.0000041497.07694.d2
33. Rankin KP. Self awareness and personality change in dementia. *Journal of Neurology, Neurosurgery & Psychiatry*. 2005;76(5):632-639. doi:https://doi.org/10.1136/jnnp.2004.042879
34. Miller BL, Seeley WW, Mychack P, Rosen HJ, Mena I, Boone K. Neuroanatomy of the self: Evidence from patients with frontotemporal dementia. *Neurology*. 2001;57(5):817-821. doi:https://doi.org/10.1212/wnl.57.5.817
35. Sturm VE, Ascher EA, Miller BL, Levenson RW. Diminished self-conscious emotional responding in frontotemporal lobar degeneration patients. *Emotion*. 2008;8(6):861-869. doi:https://doi.org/10.1037/a0013765
36. Cerejeira J, Lagarto L, Mukaetova-Ladinska EB. Behavioral and Psychological Symptoms of Dementia. *Frontiers in Neurology*. 2012;3(73). doi:https://doi.org/10.3389/fneur.2012.00073
37. Cloak, Nancy. and Yasir Al Khalili. "Behavioral and Psychological Symptoms in Dementia." StatPearls, StatPearls Publishing, 21 July 2022.