

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

Dr. Pramod Kumar^{1*}, Prof (Dr.) Ramji Lal²

ABSTRACT

The aged people's problems are mainly classified into gerontology, as biological and psychological deformity. As people get older, their brain and nervous system go through natural changes. This decline in age progresses with the chronological age but is simply a number but the mental age is very much affected. These changes are well defined and measurable in the form of different neurological and cognitive deficits. The different old-age problems are mainly involved due to malfunction of brain structure and function. The different types of old age diseases are well classified and important with ageing. In this paper we will have an overview of the new concept between neuroscientific and psychological approaches to cognitive aging. We provide a selective review of brain imaging studies and their relevance to mechanisms of cognitive aging, how to be identified primarily as behavioral changes. The normal functional capacity if assumed at the age of 30 is taken as A100 %. Then there is a decline at the age of 60 years in all vital organs. With the increase in age, but after 60 years, special care is required. The neurobehavioral parameters are very much affected with the age in progress. The assessment of these cognitive functions may be a biomarker to be assessed for any mental deformities. Cognitive science plays a vital role in maintaining neurodegenerative disease as age increases. The objective of the article is to highlight the physiological and psychological variables for the preventive and curative aspects of ageing.

Keywords: *Mental Age, Neurobehavioural, Brain Degeneration, Old Age Problems, Memory, Mind and Behaviour*

The ageing is a universal and scientific phenomenon of human life. The Brahmaprastha stage of life was started after 60 years of life in ancient times. Our Rishi and Sanyasi are well known for the process, how to cope with this stage. The past several decades have brought a tremendous expansion of research on the neural basis of aging cognition. This growth has been made possible by breakthroughs in human neuroscience methodologies that permit new discoveries about normal age-related alterations. The way to reach between cognitive and sensorimotor processes is significant changes in body and mind relationships. Recent studies on aging complexities reveal, the defects in the nervous systems and cognitive decline. (1)

¹Formally Associated (CSIR) IITR, Lucknow, India.

²Ex. Head and Dean of Social Science, Department of Psychology, Purvanchal University, Jaunpur, India.

*Corresponding Author

Received: October 06, 2024; Revision Received: November 09, 2024; Accepted: November 14, 2024

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

These variables may be as neurobehavioral markers of aging to assess early stage of central nervous system deformity.

The neurobehavioral approach markedly differs from other traditional approaches, which focus on as a psycho-marker as the same as biomarkers.

The increase in chronological age or biological age may affect the mental age and also provides a conceptual framework of the assessment process. (2)

The psychomotor and cognitive tests battery may be applicable to assess age related neurobehavioural changes along with some biological bio marker measures. The studies are needed in evaluation of the neurobehavioral factors in relation to ageing deformities. It may be easy and non-invasive techniques to determine the aging related sign and symptoms before an early stage of permanent damages. Consciousness and cognitive performance are the main factors to be assessed as neurobehavioural studies in relation to determine any deformities in these aged populations. (3) Common non-drug treatments for neurodegenerative disease are to assess the short term and long-term memory. As dementia is the main culprit to maximum all to all groups of old age problems. Different types of other abnormalities are also found according to increases with age, some are well documented and easily diagnosed.

These neurodegenerative diseases (NDD) occur when nerve cells in the brain or peripheral nervous system lose their function and coordination over time. (4)

Following Neuro Degenerative Diseases are very common in the aged population.

Alzheimer's disease: Alzheimer's disease is a progressive brain disorder that affects memory, thinking, and language. It's the most common type of dementia, causing 60–70% of cases. (5) The disease usually starts slowly and worsens over time, with the first sign often being minor memory problems. As the disease progresses, memory problems can become more severe, and other symptoms can develop, such as, confusion, disorientation in taking decisions and problems with speech.

Alzheimer's disease is in people under the age of 65 may Starts commonly and the ratio maybe 1 in every 20 people.

The possibility of Alzheimer's disease over 65 years of age is observed frequently. After 65 years of age it may start disrupting processes vital to neurons and their networks, including metabolism.

At first, Alzheimer's usually damages the connections among neurons in parts of the brain involved in memory.

Research has shown that the same risk factors associated with heart disease also may increase the risk of dementia.

Parkinson's disease Parkinson's disease (PD) is a chronic degenerative disorder of the brain that affects the nervous system and parts of the body controlled by the nerves. Symptoms usually develop slowly that includes, tremor, especially at rest, slow movement, Involuntary

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

movement, Rigidity, Trouble in walking and imbalance. At this stage cognitive impairment, Mental health disorders, dementia, sleep disorders, and pain in and around the heart.

PD gets worse over age and there is no cure. However, therapies and medicines can reduce symptoms. The most common medication for PD is Levodopa/carbidopa, which increases the amount of dopamine in the brain. Other treatment options include lifestyle adjustments and surgery. (6)

Symptoms vary from person to person. The cause of PD is largely unknown, but scientists believe it's a combination of genetic and environmental factors.

Prion disease. Prion diseases, also known as transmissible spongiform encephalopathies (TSEs), are a group of fatal, incurable, and progressive brain diseases that affect the nervous system of humans and animals. Prion diseases are caused by abnormal prion proteins that cause normal cellular proteins to fold abnormally. These abnormal prion proteins can move within cells along neurites, which are connections that nerve cells use to communicate with other cells. The abnormal accumulation of protein in the brain can cause memory impairment, personality changes, and difficulties with movement. (7)

Amyotrophic lateral sclerosis:

A nervous system disease that weakens muscles and impacts physical function.

In this disease, nerve cells break down and reduce the functional action in the muscles. It's also called as Lou Gehrig's disease and has muscle weakness, cramping, problems with coordination, stiff muscles, loss of muscle, muscle spasms, or overactive reflexes. (8)

In a higher stage of disease the difficulty in raising the foot, swallowing, drooling, lack of restraint, mild cognitive impairment. The physiological changes in the form of severe constipation, unintentional weight loss and shortness of breath.

Motor neuron disease. Motor neuron disease (MND) is the same as also known as amyotrophic lateral sclerosis (ALS), and a rare, progressive neurological condition that damages the nervous system. MND occurs when motor neurons, specialized nerve cells in the brain and spinal cord, stop working properly and die early. These motor neurons control muscle activity like walking, speaking, swallowing, breathing, and gripping.(9)

MND is not fully understood, but it is believed that environmental and genetic factors may be causative.

Huntington's disease: It's also known as Huntington's chorea, is a rare, incurable, inherited brain disorder that causes nerve cells to break down and die. It's caused by a mutation in the gene for a protein called Huntingtin. When a parent has Huntington's disease, then chances of 50% inheriting in the coming generations as, chromosome 4 that carries the HD mutation. (10)

The disease gets gradually worse over time and usually results in movement, thinking (cognitive), and psychiatric disorders.

As the disease progresses, you will need additional assistance and supervision, and will need help 24 × 7.

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

Spinal muscular atrophy (SMA) This is a rare genetic disorder that causes muscle weakness and atrophy, or shrinking, in the muscles. It's usually diagnosed in infancy or early childhood, and if left untreated, is the leading genetic cause of infant death. SMA affects the motor neurons, which are nerve cells in the spinal cord that control voluntary muscle movement.(10)

SMA can affect a child's ability to crawl, walk, sit up, and control head movements. Severe SMA can damage the muscles used for breathing and swallowing. SMA is inherited in an autosomal recessive manner, and one in every 6,000 babies is born with SMA.(11)

Spinocerebellar ataxia Spinocerebellar ataxia (SCA) This is a rare, progressive, and degenerative disease that affects the cerebellum. It's an inherited disease that's part of hereditary cerebellar ataxia. SCAs are characterized by progressive cerebellar ataxia, and may also be associated with other neurological symptoms. SCAs are a heterogeneous group of diseases with multiple types of neurological conditions. The images of the brain to look somewhat different than others are easily diagnosed.(12)

Symptoms of Neurodegenerative diseases:

Mostly all types of NDD are very much related to each other according to symptoms and cognitive level. Cognitive science has a very important role in maintaining the NDD. Most common symptoms are, dementia, Ataxia, Multiple systems of atrophy and neuropathy.

The reason may be the combination of genetic and environmental factors, making it difficult to establish the causes of disease. The greatest and common risk factor for many NDD is age and defective DNA and gene DNA structure has also been linked to neurodegenerative disorders.

In the areas of biological research the brain structure and function are linked to age-related declines in performance and measures of cognition (Reuter-Lorenz and Park, 2010) (14)

Aging and complexity in the brain function are well documented and neurobehavioral systems may also be affected. The issue of complexity is more and more highlighted in numerous domains of biological research and aging research. In the present scenario, a selective review of literature, we may understand both a conceptual and a methodological framework to address the age-related and functional complexity in the neurobehavioral system.(15)

For decades, doctors and researchers believed dementia could not be prevented or cured, but new research suggests that if you have some clue early it may be manageable to some extent. European ancestry, suggested that lifestyle factors such as smoking, physical activity, diet, and alcohol consumption could potentially contribute to the risk of dementia.(16)

The brain-based approaches are having an impact on the study of cognitive aging along with the structure and function of the brain itself. Neuroscience evidence can specify psychological constructs derived from behavioral studies.

Psychosocial theories of aging are old but current research in the area of neuroscience reveals that the Study involves in the physical, mental, and social changes in health to improve after retirement in quality of living. The mental and emotional wellbeing and social interaction also may cause aging deformities.

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

Gerontologist Robert J. Havighurst, (1961) reveals the activity theory of aging that is based on the idea that those older people, who are active are more satisfied in their lives than those who are less suffering from NDD. As people age and retire, showing more symptoms than those who are taking social responsibility and active in life. (17)

The activity theory of aging proposes that the older adults who are involved in the activities and have social interaction enjoyed a better life and to get better self-concept and adjustment in the process of growing older. (17 b)

METHODOLOGY

Biological variables:

Glasgow Coma Scale (GCS)

This tool is used to evaluate the level of Consciousness (LOC) of patients. It assesses the old person's symptoms, based on their eye opening, motor, and verbal responses. The GCS was developed in 1974 by experts at the University of Glasgow.(18)

EEG:

This technique measures cortico cortical communication, which is the primary target for assessing consciousness in the clinical domain.

- **Weak magnetic pulse:** This technique involves applying a weak magnetic pulse to the head of a patient. The brain's response to the pulse is then measured.
- **Post-decision wagering (PDW):** This technique is considered a direct and objective measure of consciousness because it doesn't ask for subjective reports.
- **Brain shrinkage:** The brain shrinks with age, including parts that are important for learning and other complex mental activities.
- **Brain weight loss:** The brain and spinal cord lose nerve cells and weight be measured easily.
- **Nerve cell changes:** Nerve cells may begin to pass messages more slowly than in the past. They may also produce a compound called amyloid-beta which is responsible for Nerve conduction velocity.
- **Waste product buildup:** Waste products or other chemicals such as beta amyloid can collect in the brain tissue as nerve cells break down as part of activity of antioxidants.
- **Neurotransmitters and hormones:** The brain has neurotransmitters and hormones role along with the action in the antioxidants to control free radicals.(19)

Psychological variable:

- **Intelligence affects:** The combination of test batteries may also be used to determine the intellectual and cognitive capacity.
- **Mood disorders:** Modestly Personality Inventory along with subjective questionnaires, may be used to see the mood and personality trends.
- **Dexterity movement disorders:** The psychomotor coordination also measures to see the eye hand coordination as a locomotion disorder. Atoxia and other abnormalities.
- **Memory loss:** The main NDD, have very prominent and common features are loss of cognitive function specially loose of memory. The long term and short term memory are also responsible in aging this may also be measured by a suitable test.(20)

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

The detection and tracking of progressive memory impairments, particularly in the context of neurodegenerative disorders, the neuropsychological assessment and short cognitive screening tools are suitable.

The critical need of clinical evaluation for reliable and efficient diagnostic tools to track and predict memory decline. (21) The working memory of everyday events can be recalled as past and present experiences, that occur at particular times and places are also assigned by the psychological evaluation. Episodic memory is considered to be the most age-sensitive system, with an average onset of decline around 60 years of age. (22)

Other symptoms change:(23)

1. Decreased blood flow in the brain and hormonal disturbances.
2. Increased inflammation in muscular atrophies and muscular weakness along with muscular neuropathy.
3. Tremors and muscular neuropathy and weak coordination.
4. The brain and nervous system go through natural changes, the brain and spinal cord activities.
5. Nerve cells may begin to pass messages more slowly than in the past, measured by nerve conduction velocity.
6. Some common subjective symptoms of aging in the brain may also be measured by semi structured questionnaires.

Proposed Neurobehavioural test battery:(SOP)

The proposed neurobehavioural testing may be conducted in the aged person to see their deterioration in the central nervous system. The simple paper pencil, culture free and performance test may be used.

The battery contains the following tests of cognitive functions:(24)

- A. Digit Span test, Digit symbol test and picture completion/ Block design test. (WAIS)
- B. Visual reproduction and Associative learning.
- C. Dot cancellation test or figure identification test.
- D. Finger tapping test / Reaction time test
- E. Semi structure Questionnaire/ MPI/ EPI.

Recommendations:

The main symptom of all NDD are the unforgettable ness or loss of memory. The problem diagnosed by medical sciences is Dementia. Our proposed objectives of this study is how and early assessed it and to prevent ageing with these symptoms in early stage and we can prevent Dementia by controlling the main problem of ageing and be happy older life.(25)

Our main objective should be to prevent dementia, (26) It was also based on medication under expert supervision associated with the therapies to better manage the symptoms.

Occupational therapists and specialized healthcare professionals who are well known to be using safer and more secure tasks including walking, talking and cycling.

Habit formation:

- The best defense against age-related cognitive deterioration is doing practice of any task and at the stage of the habit formation and make self-dependent.

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

- Daily practice of the same task can lead to compensatory strategies and alternative ways to develop adoptive tasks of day to day routine are in habit formation.
- The mediation and jaap (MALA) may increase the attention and coordination in the brain body relationship.
- Healthy diet and organic food are best to control the antioxidant and decrease the free radicals that are responsible for aging deformities.

CONCLUSION

Cognitive neuroscience has given rise to new theories of cognitive aging that focus on functional or structural mechanisms to explain both deficient and preserved cognitive performance in older adults. (27) Here, we briefly review a few of these new theoretical accounts that integrate brain imaging data with, cognitive behavioral effects will assess during the process of evaluation. The new generation of cognitive neurobehavioural theories incorporate critical factors for cognitive assessment in the understanding of aging in mind. (28)

The mild Aerobic fitness reduces brain tissue loss in aging humans, and mild exercise oxygen therapy and the brain exercise including reading and writing also prevents brain damage. (29)

Delimitation of the study:

- The research in NDD is conducted by the neurologist and in the area of neuroscience.
- The Hormonal disturbances in post menstrual cycle in females improving their psychological and mental health. (30)
- The same type of clinical trials should be suggested in NDD cases in the early stage of diseases.

REFERENCES

- (1) Patricia A. Reuter-Lorenz, Denise C. Park (2010), Human Neuroscience and the Aging Mind: A New Look at Old Problems. *The Journals of Gerontology*: 65, (4) 405–415
- (2) Bernard, J. A., & Seidler, R. D. (2012). Evidence for motor cortex dedifferentiation in older adults. *Neurobiology of Aging*, (9) 33.
- (3) Bialystok, E., Craik, F. I. M., & Luk, G. (2012). Bilingualism: consequences for mind and brain. *Trends in Cognitive Sciences*, 16(4), 240–250.
- (4) Birren, J., & Schaie, K. W. (2005). *Handbook of the psychology of aging* (6th ed.). Elsevier: Amsterdam.
- (5) Bialystok, E., Craik, F. I. M., & Freedman, M. (2007). Bilingualism as a protection against the onset of symptoms of dementia. *Neuropsychologia*, 45(2), 459–464.
- (6) Boron, J., Willis, S. L., & Schaie, K. (2012). Personality as a predictor of intraindividual variability in cognitive function across adulthood. *Gerontologist*, 52, 192–192.
- (7) Boyle, P. A., Wilson, R. S., Yu, L., Barr, A. M., Honer, W. G., Schneider, J. A., et al. (2013). Much of late life's cognitive decline is not due to common neurodegenerative pathologies. *Annals Neurology*, 74(3), 478–489.
- (8) Brehmer, Y., Rieckmann, A., Bellander, M., Westerberg, H., Fischer, H., & Backman, L. (2011). Neural correlates of training related working-memory gains in old age. *Neuroimage*, 58(4),

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

- (9) Bressler, S. L., & Menon, V. (2010). Large-scale brain networks in cognition: emerging methods and principles. *Trends in Cognitive Sciences*, 14(6), 277–290.
- (10) Huntington's disease: (2022) Hope through research. National Institute of Neurological Disorders and Stroke. (Press)
- (11) Brickman, A. M., Honig, L. S., Scarmeas, N., Tatarina, O., Sanders, L., Albert, M. S., et al. (2008). Measuring cerebral atrophy and white matter hyperintensity burden to predict the rate of cognitive decline in Alzheimer disease. *Archives of Neurology*, 65(9), 1202–1208.
- (12) Brickman, A. M., Meier, I. B., Korgaonkar, M. S., Provenzano, F. A., Grieve, S.M., Siedlecki, K. L., et al. (2012). Testing the white matter retrogenesis hypothesis of cognitive aging. *Neurobiology of Aging*, 33(8), 1699–1715.
- (13) Brickman, A. M., Muraskin, J., & Zimmerman, M. E. (2009). Structural neuroimaging in Alzheimer's disease: do white matter hyperintensities matter? *Dialogues in Clinical Neuroscience*, 11(2), 181–190.
- (14) Patricia A. Reuter-Lorenz, Denise C. Park (2010) Human Neuroscience and the Aging Mind: A New Look at Old Problems, *The Journals of Gerontology: Volume (65)B*, 4, 405–415.
- (15) Burzynska, A. Z., Garrett, D. D., Preuschhof, C., Nagel, I. E., Li, S. C., Backman, L., et al. (2013). A scaffold for efficiency in the human brain. *Journal of Neuroscience*, 33(43), 17150–17159.
- (16) Christensen, H., Batterham, P. J., Mackinnon, A. J., Anstey, K. J., Wen, W., & Sachdev, P. S. (2009). Education, atrophy, and cognitive change in an epidemiological sample in early old age. *American Journal of Geriatric Psychiatry*, 17(3), 218–226.
- (17) Chapman, S. B., Aslan, S., Spence, J. S., Hart, J. J. Jr., Bartz, E. K., Didehbani, N., Keebler, M. W., Gardner, C. M., Strain, J. F., Defina, L. F., Lu H. (2013). Neural Mechanisms of Brain Plasticity with Complex Cognitive Training in Healthy Seniors. *Cerebral Cortex*. (28) (17 B)- *Front. Aging Neurosci.* (2013) Sec. Neurocognitive Aging and Behavior, (5)
- (18) Royal College of Physicians and Surgeons of Glasgow coma scale, (2023) glasgowcomascale.org. Multiple pages reviewed: "What is the Glasgow Coma Scale?"
- (19) Cabeza, R. (2002). Hemispheric asymmetry reduction in older adults: The HAROLD model. *Psychology and Aging*, 17(1), 85–100. HAROLD model and Cabeza, R. (2004). Task-independent and task-specific age affects brain activity during working memory, visual attention and episodic retrieval. *Cerebral Cortex*, 14(4), 364–375.
- (20) Cabeza, R., Nyberg, L., & Park, D. (2005). *Cognitive neuroscience of aging: Linking cognitive and cerebral aging*. New York: Oxford University Press.
- (21) Cappell, K. A., Gmeindl, L., & Reuter-Lorenz, P. A. (2010). Age differences in prefrontal recruitment during verbal working memory maintenance depend on memory load. *Cortex*, 46(4), 462–473.
- (22) Carp, J., Gmeindl, L., & Reuter-Lorenz, P. A. (2010). Age differences in the neural representation of working memory revealed by multivoxel pattern analysis. *Frontiers in Human Neuroscience*, 36(7):2514–2526.
- (23) Ying Liu, H Jun, A Becker, C Wallick, S Mattke :(2024) Detection Rates of Mild Cognitive Impairment in Primary Care for the United States Medicare Population: *The Journal of Prevention of Alzheimer's Disease* 11 (1), 7-12.
- (24) Kumar, P. (2023), *The Study of Mind in Neurobehavioral Studies: A New Prospective*, *The International Journal of Indian Psychology*, (11) Issue 4, DIP: 18.01.038.20231104, DOI: 10.25215/1104.038 <https://www.ijip.in>

Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment

- (25) Cherbuin, N., Reglade-Meslin, C., Kumar, R., Jacomb, P., Eastaer, S., Christensen, H., et al. (2009). Risk factors of transition from normal cognition to mild cognitive disorder: the path through life study. *Dementia and Geriatric Cognitive Disorders*, 28(1), 47–55.
- (26) Carp, J., Park, J., Hebrank, A., Park, D., & Polk, T. (2011). Age-related neural dedifferentiation in the motor system. *Plos One*, 6(12), e29411.
- (27) Cherry, K. E., Park, D. C., Frieske, D. A., & Rowley, R. L. (1993). The effect of verbal elaborations on memory in young and older adults. *Memory & Cognition*, 21, 725–738.
- (28) Cherry, K. E., Park, D. C., Frieske, D. A., & Smith, A. D. (1996). Verbal and pictorial elaborations enhance memory in young and older adults. *Aging, Neuropsychology, and Cognition*, 3, 15–29.
- (29) Colcombe, S. J., Erickson, K. I., Raz, N., Webb, A. G., Cohen, N. J., McAuley, E., et al. (2003). Aerobic fitness reduces brain tissue loss in aging humans. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 58(2), 176–180.
- (30) Rueda Beltz, C., Muñoz Vargas, B. A., Davila Neri, I., & Diaz Quijano, D. M. (2024). Neuroprotective effect of hormone replacement therapy: a review of the literature. *Climacteric*, 27(4), 351–356. <https://doi.org/10.1080/13697137.2024.2354759>

Acknowledgement

The author(s) appreciates all those who participated in the study and helped to facilitate the research process.

Conflict of Interest

The author(s) declared no conflict of interest.

How to cite this article: Kumar, P. & Lal, R. (2024). Neuro Degenerative Diseases in Aged Population: New Prospects of Assessment. *International Journal of Indian Psychology*, 12(4), 1184-1192. DIP:18.01.110.20241204, DOI:10.25215/1204.110