REVIEW ARTICLE

Impaired Cognition – A Menace to Aging

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DOI: 10.55489/njcm.140220232125

ABSTRACT

Cognition is defined as mental process of acquiring knowledge and understanding through thought, experience and senses. It is an age-related degenerative condition, as the age advances, individuals experience deteriorative changes in their cognitive abilities. It is estimated that nearly four fifth of the elderly above 60 years of age will be living in developing countries like Africa, Asia by 2050, thereby placing the developing countries to face threat of cognitive impairment among elderly when compared to developed countries. The result of striking increase in aging population of India, it is expected to have a substantial increase in elderly suffering from cognitive impairment. This review involves discussing the various causes, pathophysiology, modifiable and non-modifiable risk factors associated with this increasing cognitive deterioration in elderly people, diagnostic criteria, and preventive methods. This review will help in better understanding of the cognitive impairment in elderly people. Better understanding of the disease helps in better treatment modalities.

Key words: Cognition, Cognitive impairment, Cognitive deterioration

ARTICLE INFO

Financial Support: None declared
Conflict of Interest: None declared
Received: 31-05-2022, **Accepted**: 01-02-2023, **Published**: 28-02-2023
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How to cite this article:
Sujitha P, Swetha NB. Impaired Cognition – A Menace to Aging. Natl J Community Med 2023;14(2):118-123.
DOI: 10.55489/njcm.140220232125

www.njcmindia.com | pISSN09763325 | eISSN22296816 | Published by Medsci Publications

Introduction

Cognition encompasses skills like attention, learning, language, visuospatial skills, and other executive functions like decision making, problem solving and judgment.[1] Cognition is defined as mental process of acquiring knowledge and understanding through thought, experience and senses.[2] The term Cognition is derived from a Latin word cognito meaning knowledge. Though the word dates back to 15th century, focus began in 18th century, beginning with Aristotle.[2] Cognitive impairment is an age-related degenerative condition and is considered as a precursor to many diseases. As age advances, individuals' experiences deteriorative changes in their cognitive abilities.[1] As a broad term cognitive impairment deals with impairment in any one (or all) of the cognitive domains irrespectively of the underlying pathology. As per the ICD-11 report dated 2018, WHO has classified neuro cognitive disorders in 2 chapters. The dementia components are included in chapter 6 Mental and Behavioral disorders and their underlying causes represented in chapter 8 Diseases of the Nervous system.[3]

Problem Statement

Worldwide it is estimated that nearly 35.6 million people are currently suffering from impaired cognition and it is expected to double every by 20 years, thereby attaining 115.4 million people by 2050, of which majority will be in developing countries. Of this estimate, 57.7% lived in developing countries in 2010 which is expected to reach 70.5% by 2050.[4] The demographic shift is well coinciding with the increased prevalence of chronic diseases accompanied by prolonged life expectancy among the developing countries. A study done in 2017 states that the Global prevalence of cognitive impairment is 15-20% in elderly above 65 years of age. From this study incidence of cognitive impairment was estimated to range between 51-77/1000 person years.[1]

Cognitive impairment is distinct from dementia, in the latter degree of impairment affects day to day activities. The degree of cognitive decline ranges from cognitive impairment to dementia to Alzheimer's disease. It is estimated that nearly four fifth of the elderly above 60 years of age will be living in developing countries like Africa, Asia by 2050, thereby placing the developing countries to face threat of cognitive impairment among elderly when compared to developed countries.[4] As per 2011 census, there is a rapid changed in the age framework of India. It has been reported that elderly population is more than 100 million and is expected to rise to 300 million by 2050, thereby making India the leading country with elderly when compared to Japan. [2] As a result of this striking increase in aging population of India, it is expected to have a substantial increase in elderly suffering from cognitive impairment.[1]

Causes of Cognitive Impairment

Common causes of cognitive impairment in older adults include [5]:

1. **Medication side-effects:** Sedatives, tranquilizers and anticholinergic drugs interfere with normal brain functions.
2. **Metabolic imbalance:** changes in blood chemistry due to altered levels in electrolytes and liver enzymes and renal enzymes
3. **Hormonal imbalance**: thyroid problems, estrogen abnormalities may also affect cognitive function
4. **Nutritional deficiencies:** Low levels of vitamin B12, folate etc are expected to have negative effects over brain functions
5. **Psychiatric problems:** delirium, paranoia and many other cute or chronic psychiatric conditions tend to have problems with thinking, concentration and memory
6. **Substance abuse/ substance withdrawal:** Acute intoxication and chronic overuse of substances like alcohol, illicit drugs, or even prescription drugs can impair brain function.
7. **Head injury:** Vascular damages to neurons like stroke or cerebral vessel damages, head injuries are associated with temporary or longer-lasting cognitive impairment.

Pathophysology of Disease

Increased CSF phosphorylated tau and decreased Aβ-42 protein levels increase the short-term risk of conversion to Alzheimer disease in mild cognitive impairment patients. Decreased metabolism in temporal-parietal regions, including the precuneus (detected with fluorodeoxyglucose-PET), and increased amyloid deposition (detected with amyloid ligands) increase the risk of conversion to Alzheimer disease.[3]

Epidemiology

Identifying major risk factors and protective factors plays a vital role toward controlling progression of cognitive impairment. Major risk factors can be broadly classified as Modifiable and Non-modifiable risk factors. Targeting the modifiable risk factors to reduce the speed of progression of cognitive impairment with age and delay the onset of clinical dementia is the most effective strategy. Progressive cognitive impairment may lead to dementia and Alzheimer. A number of factors influence the development of cognitive impairment.

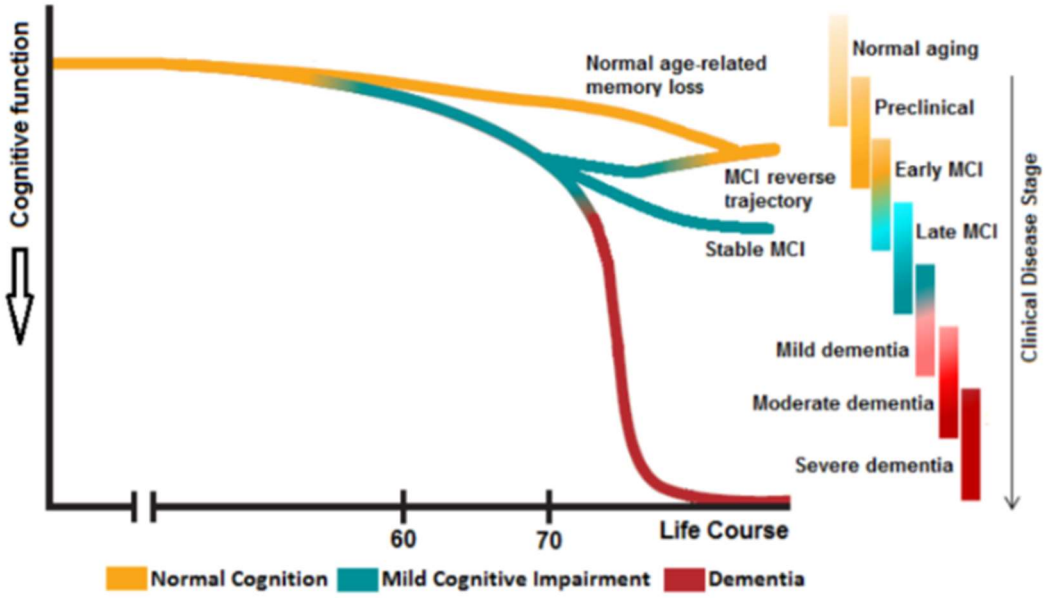

Figure 1: The disease continuum from normal cognition to severe dementia [4]

NON-MODIFIABLE RISK FACTORS[6]

Age: One of the most predominant risk factors for development of cognitive impairment is age. Cognitive impairment exponentially increases with advancing age and also doubles with every five years after the age of 60.[5]

Gender: Disproportionate evidence has been observed between gender and development of cognitive impairment. Women are believed to be at a higher risk when compared to women[6]. Lower health status of women and hormonal factors in woman could also be possible factors to justify. The decrease in estrogen level due to aging may have an adverse effect on the cognitive function[7]

Family history and genetics: Evidences show that people with positive family history of dementia are at risk of developing cognitive impairment progressing to dementia. Many evidences suggest that ε4 allele of the apolipoprotein E gene (APOE4) is a major risk factor associated with development of impairment progressing to Alzheimer, thereby contributing strong proof of Cognitive impairment being familial.[8,9]

MODIFIABLE RISK FACTORS[7]

Socioeconomic status: People with low personal income are found to be at increased risk of developing cognitive impairment. This could be because of reduced nutritional intake, less consumption of nutritious diet, inadequate access to health care services, inadequate social activity.[10] Studies suggest that Illiteracy, poverty and unemployment have strong association with cognitive impairment. These three factors could be interrelated as lack of education could be linked with lower socio-economic status which may further be associated with negative health, inadequate access to health care. With better education and employment, cognitive reserve is maintained. [11]

Vascular diseases and hypertension: Cerebrovascular and neurovascular systems control integrity of brain tissue and its activity by assuring constant blood flow. Individuals with cardio vascular diseases are at risk of developing cognitive problems.[12]

Diabetes: Type2 diabetes affects the learning and memory component of cognition. People with insulin resistance and metabolic syndrome have an increased risk of cognitive impairment.[12]

Traumatic head injury: Previous history of head injury with loss of consciousness is a possible risk factor for development of cognitive impairment. in addition, presence of E4 allele, has a tenfold risk of developing cognitive impairment. [12]

Epilepsy: Epilepsy is referred to as neurological disorder leading to seizures due to abnormal firing in the neurons leading to brain atrophy, thus prone to cognitive impairment. Epileptic disorders at young age are a prone risk factor for developing cognitive impairment.[11]

Depression: Depression is a serious illness inclusive of extensive mental health issues. Triad for depression includes anhedonia, fatigue and low mood. Depression is a common symptom associated with dementia. Late life depression is a crucial risk factor for cognitive impairment[13].

Lifestyle modifications [8]

Leisure activities: Activities like reading books, learning multiple languages, solving puzzles, social

engagements are found to have protective effect over development of cognitive impairment. Cognitive leisure activities during midlife are noticed to have protective effect over impairment of cognition in late life. [5]

Body mass Index (BMI): On a contrary, overweight individuals are found to have a reduced risk of developing cognitive impairment when compared to normal BMI individuals. Higher BMI reflects higher fat percentage which improves glucose metabolism and higher cerebral glucose metabolism which might lower risk.[7]

Physical activity: Physical activities include walking for 30 minutes/day, intensity training, swimming, aerobics etc. Moderate physical training reverses hippocampal shrinkage which occurs as age degenerative process. Regular physical activities are prone to have favorable outcome on improving cognition. [11]There is no significant inhibition of amyloid deposition as a result of regular activates witnessed so far.

Sleep disturbance: Sleep wake cycle is described as 16 hours of being awake and 8 hours of sleeper day. Being controlled by brains circadian rhythm, sleep plays a pivotal role in functions and in removing toxins that are accumulated in the brain throughout the day.[14] Disruptions in sleep wake cycle are considered a risk factor for cognitive impairment.[11]

Diet pattern: Strong evidence is noticed that well balanced diet may be beneficial against cognitive impairment. Though these diet patterns don't directly influence the incidence of dementia, they are believed to prolong the onset of cognitive impairment among the elderly population.[11]

Smoking& Alcohol: Tobacco use is found to be a strong risk factor for development of cognitive impairment showing faster decline in verbal memory and slow visual search speed. The degree of dose-response relationship, suggests that, higher the amount of smoking, the greater the risk of developing cognitive impairment.[11] Heavy drinking is described as consuming more than four drinks a day (or 14 drinks a week) for males and consuming more than three drinks a day (or seven drinks a week) for females, whereas moderate drinking is 1–2 drinks/day.[12]

Diagnostic Criteria

The diagnostic criteria for cognitive impairment is based on the following:[15]

1. Concern regarding any change in the cognitive function from the patient or any knowledgeable informant or physician observing the patient
2. Objective evidence of cognitive impairment in any one or more cognitive domains like memory, attention, lingual. Visuospatial skills
3. Assessing their preservation of independence in their activities of daily living
4. No evidence of significant dementia

The use of the criteria in clinical practice is difficult. Cognitive impairment subjects with multiple disease processes that can affect cognition and progress to AD. [16]

Measurement of Cognitive Impairment

A detailed history of the patient along with history of changes of cognitive function over time is important for identifying the first diagnostic criteria. The symptoms are always gradual and never rapid in Cognitive impairment. Assessment of cognitive function can be done using standardized scales. These tools help physician to early diagnose the patient and provide care and support. Some tools used in assessing cognitive impairment of elderly are mentioned below:

1. The Montreal Cognitive Assessment (MoCA) is a screening tool that was developed to assess cognitive function of the individual. Using a cut-point of 25/26, the MoCA has a sensitivity of 80 to 100% and specificity of 50 to 76% for detecting MCI. [17]
2. The Mini-Mental State Exam (MMSE) has a sensitivity of45 to 60% and specificity of 65 to 90% for detecting MCI using cut-points of 27 or 28. [18]
3. Clinicians can collect standardized information on cognitive function from informants using the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)[19]
4. Brief Interview for Mental Status

Investigation and Management[9]

Investigations: Regular blood investigations like CBC, electrolytes, sugars, calcium, folate, Vitamin B12 and electrolytes are recommended for early identification of reversible cognitive impairment. Liver function test and renal function tests may reveal rares causes of cognitive impairment. CSF examination, neuro imaging biomarkers can be added to improve identification of brain pathology in in patients with MCI and predict its likelihood of progressing dementia.

Medical Therapy: Currently, there is no drug proven effective in treatment of Cognitive impairment. Optimizing patients' general condition and their functional status medical and functional status may reduce the risk of negative outcomes.

Counseling: There is modest evidence from RCTs and clinical studies that various behavioral interventions, particularly aerobic exercise and mental activity, may have beneficial effects on cognitive function in elderly with MCI. Many RCTs conducted among community dwelling adults at risk of developing cognitive impairment show that exercise or re-

sistance training modestly improves cognitive function, over 18-months of follow-up. [20], [21]

Prevention of Cognitive Impairment

Cognitive impairment can be prevented with the following approaches

Primordial prevention: The purest form of primary prevention is termed as primordial prevention. Children are the target group among whom emphasis to follow healthy lifestyle habits is uncultivated by which they can be prevented from developing risk factors for cognitive impairment in future. Best place to attain this approach is schools.[22]

- Regular & moderate physical activity since childhood.
- Optimum nutrition
- Abstain from smoking & alcohol
- Avoid self-medication
- Making hobbies of reading, writing, listening to music, gardening, spiritual bent of mind
- Financial security in adulthood itself

Primary prevention: Primary prevention comprises of all the measures taken to prevent incidence of Cognitive impairment, which can be attained by risk factor reduction. [23]

Population strategy: The whole community is targeted irrespective of risk of individuals. To attain this level of prevention measures like Immunization, Regular Physical activity, Nutritional intervention, abstinence from smoking, alcohol, creating Geriatric-friendly atmosphere, Basic Education, Learning Additional Languages and Health Education can be done.

High risk strategy: The ultimate aim of this approach is to prevent development of cognitive impairment. Detection of high-risk groups can be done by enquiring family history of dementia and obtaining a detailed history of risk factors if any

Secondary prevention: Secondary prevention can be achieved by early diagnosis and prompt treatment. By this way progression of disease may be controlled, by which incidence of impairment could be reduced to greater extent. Measures comprises of early diagnosis of diseases, screening for diseases (HTN, DM, Cancer, Ocular diseases, Deafness-hearing aids, Osteoporosis, Osteoarthritis), counseling, medication for mental disorders various recreational activities, counseling family members to adjust and accept the diagnosis.[24]

Tertiary prevention:

Tertiary prevention aims at interventions done to reduce damage caused by disease. Rehabilitation services plays vital role to enhance functional abilities [25] Senior citizen clubs, Day care centers, Laughter clubs, Old age homes, Cultural activities-bhajans, Religious congregations, Classes in Yoga, Trips, tours and Exercise may be fruitful. Intensified IEC activities focusing on awareness of psychological status, early diagnosis, prompt treatment and adherence to treatment with chronic diseases may have a great impact over the growing adults.[10]

National Mental Health Program (NMHP)

The NMHP was launched in 1982 by MOHFW, Government of India. NMHP provides mental healthcare for all, create mental health awareness and promote community participation. In aspects of elderly population, this program targets senior citizens suffering from dementia, Alzheimer's, Parkinson's, depression and other psycho geriatric disorders.

The NMHP aims to provide[26] prevention and management of mental and neurological conditions; use of mental health technology to improve health services, and measures to uplift quality of life by applying mental health principles in gross national development.

Objectives of NMHP

The objectives of NMHP are to ensure availability and accessibility of mental health care services for all, especially to vulnerable and at-risk population; to encourage application of mental health knowledge in field of healthcare and social development; to promote community participation in development of services related to mental health care; and to stimulate efforts towards self-help in community

Families with people affected by mental health bear negative impact of stigma. In spite of providing physical and emotional support, they undergo discrimination by the society. Nearly 90% of them remain untreated. Reasons for such huge treatment gap may be due to lack of awareness on mental health, poor knowledge on treatment availability etc.[27]

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