



ASSESSMENT OF DEMENTIA IN PATIENTS WITH TYPE-2 DIABETES MELLITUS

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Abstract

Background: The duration of diabetes and poor glycaemic control can be considered as an important contributor of Diabetes mellitus (DM) on dementia. The longer the duration of Diabetes mellitus (DM) can be more likely affecting dementia by declining their cognitive levels. Thus, Understanding the duration of diabetes and its correlation with dementia can help in benefiting patients by planning a better rehabilitation program by improving their cognitive levels that will eventually lead to better quality of life.

Methods: A cross-sectional study was conducted on subjects with type 2 diabetes mellitus (DM) aged 41 to 60 years. Total 60 samples were collected using convenient sampling method. Participants were selected for study based on inclusion criteria (prolonged duration of type 2 Diabetes Mellitus (DM) > 10 years of duration) and exclusion criteria [individuals with pre-existing co morbidities other than type 2 Diabetes Mellitus (DM)]. Addenbrooke's cognitive examination – III (ACE – III) was used for assessment of dementia in subjects with diabetes mellitus. The data was analysed using IBM SPSS 23.0 Software.

Result: Out of 60 subjects, the groups with diabetes for 10 to 15 years has the highest score of 45% indicating better cognitive performance. The group with diabetes for 15 to 20 years has a lower score of 34%. The group with diabetes for more than 20 years shows the lowest score of 21%. Out of 60 subjects participating in the study, 38% of the individuals do not have dementia, while remaining 62% of the individuals are diagnosed with dementia.

Conclusion: It can be concluded that Dementia is prevalent among individuals with Type 2 Diabetes Mellitus.

Index Terms: Dementia, Diabetes mellitus, Addenbrooke's cognitive examination – III (ACE – III)

I. INTRODUCTION

Diabetes is a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both.^[1] It happens when the body either cannot use the insulin it generates efficiently or does not make enough of it.^[1]

Diabetes comes in a variety of types, with Type 2 Diabetes being the most prevalent. Insulin-producing beta cells in the pancreas are attacked and destroyed by the immune system in type 1 diabetes, an autoimmune disease that results in a lifelong insulin shortage.^[1,2] The exact cause is not clear, but it is believed to involve genetic and environmental factors rather than lifestyle changes.^[1,2] Usually, insulin resistance- a condition in which the body is unable to use insulin effectively- is the first sign of type 2 diabetes, which results in elevated blood sugar.^[1]

Diabetes's long-term effects include retinopathy, which can result in blindness; nephropathy, which can cause renal failure; peripheral neuropathy, which can cause foot ulcers, amputations, Charcot joints and autonomic neuropathy, which can cause symptoms related to the gastrointestinal tract, genitourinary system, cardiovascular system, and sexual function.^[3] Neurovascular, peripheral arterial, and atherosclerotic cardiovascular diseases are more common in diabetic patients.^[3] Individuals diagnosed with diabetes frequently have hypertension, anomalies in lipoprotein metabolism, cognitive decline, and dementia.^[3]

Diabetes Mellitus (DM) has been linked to cognitive impairment, especially in the elderly, cognitive decline, and an increased risk of dementia, including vascular dementia and Alzheimer's disease (AD).^[4] A dangerous neurological condition that becomes more common as people age is dementia.^[5] In comparison to the normal senior group, the type 2 diabetes group had a considerably greater prevalence of dementia (25.5%), according to a study done in the Chinese population.^[5]

The duration of diabetes and poor glycaemic control can be considered as an important contributor of Diabetes mellitus (DM) on dementia.^[6] The longer the duration of Diabetes mellitus (DM) can be more likely affecting dementia by declining their cognitive levels.^[6] Thus, Understanding the duration of diabetes and its correlation with dementia can help in benefiting patients by planning a better rehabilitation program by improving their cognitive levels that will eventually lead to better quality of life

II. METHODOLOGY

A cross-sectional design was used to determine the assessment of dementia in subjects aged 41 to 60 years with type 2 diabetes mellitus (DM) at D.Y. Patil Hospital, with locations in both Navi Mumbai and Mumbai. As we all know, the risk of dementia is common in individuals with diabetes, with a prevalence of 25.5%. The purpose of our study was to assess the severity of dementia in diabetic patients in relation to the duration of their diabetes. This will help us develop a structured protocol to better benefit these patients. The duration of the study was 6 months. Participants were selected for study based on inclusion criteria (prolonged duration of type 2 Diabetes Mellitus (DM)>10 years of duration) and exclusion criteria (individuals with pre-existing comorbidities other than type 2 Diabetes Mellitus (DM)). A consent form was taken prior to the participation in the study. The subjects will be assured that the information and their respective identities will be strictly kept confidential. Further data was compiled and arranged for statistical analysis. All the participants were assessed for demographic details, duration and type of diabetes. A self-made questionnaire was circulated amongst the study population. In addition to the questionnaire, Addenbrooke's cognitive examination – III (ACE – III) was used for the diagnosis. The data was collected using an offline self-made questionnaire. Statistical Analysis was done and results were calculated.

III. RESULTS AND DISCUSSION :

Our studies showed the following results, out of 60 subjects participating in the study, 65% are males and rest 35% are females. Out of 60 subjects, 46% of individuals with diabetes for 10 to 15 years had impaired attention, 33% of those with diabetes for 15 to 20 years had impaired attention and 21% of those with diabetes for more than 20 years had impaired attention scores. Out of 60 subjects, 45% of individuals with diabetes for 10 to 15 years had impaired memory. In comparison, 33% of those with diabetes for 15 to 20 years had impaired memory, and 22% of individuals with diabetes for more than 20 years had impaired memory. Out of 60 subjects participating in the study, individuals with diabetes for 10 to 15 years have the highest fluency impairment score 42%. In contrast, those with diabetes for 15 to 20 years have a lower score of 35%, and

individuals with diabetes for more than 20 years have the lowest score 23%. Out of 60 subjects, individuals who have suffered from diabetes for 10 to 15 years had the greatest language impairment score 48%. On the other hand, people who had diabetes for 15 to 20 years scored lower at 35%, and those who have had the disease for more than 20 years scored the lowest at 17%. Out of 60 subjects, the group with diabetes for 10 to 15 years shows the highest visuospatial abilities impairment score at 42%. Those with diabetes for 15 to 20 years have a lower score of 34%, and individuals with diabetes for more than 20 years have the lowest score of 24%.

Out of 60 subjects, the groups with diabetes for 10 to 15 years have the highest score of 45%, indicating better cognitive performance. The group with diabetes for 15 to 20 years has a lower score of 34%. The group with diabetes for more than 20 years shows the lowest score of 21%, suggesting the greatest cognitive impairment.

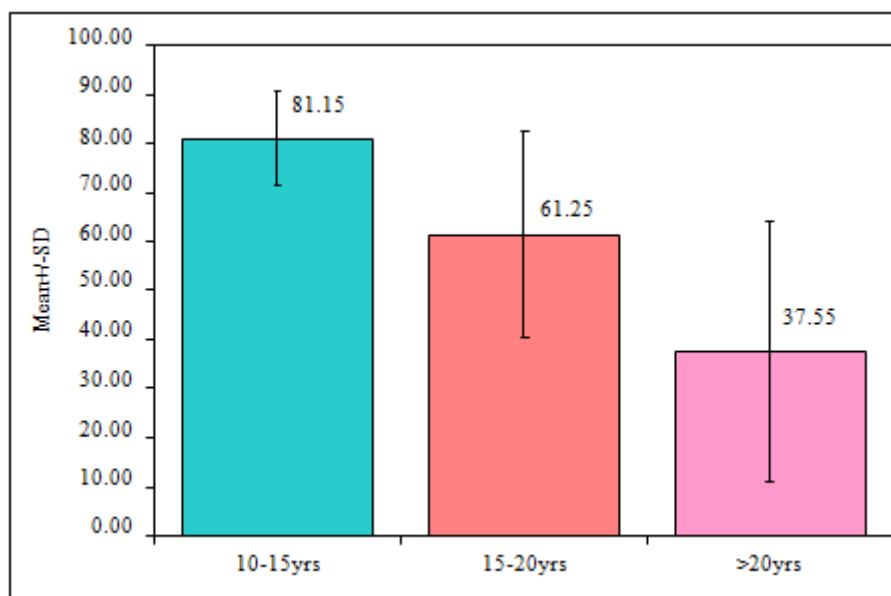


Figure no 1 : Average score of Addenbrooke's cognitive examination – III (ACE-III scores)

Table no 1 : Average score of Addenbrooke's cognitive examination – III (ACE-III scores)

Duration of Diabetes	Mean ACE-III Score	ACE-III Score Percentage
10–15 years	81.15	45%
15–20 years	61.25	34%
More than 20 years	37.55	21%

Out of 60 subjects, 45% of individuals in the 10-15 years duration group have the highest average ACE-III score of 81.15. In comparison, 34% of individuals in the 15-20 years duration group have an average ACE-III score of 61.25. Lastly, 21% of individuals who have had the condition for more than 20 years have the lowest average ACE-III score of 37.55

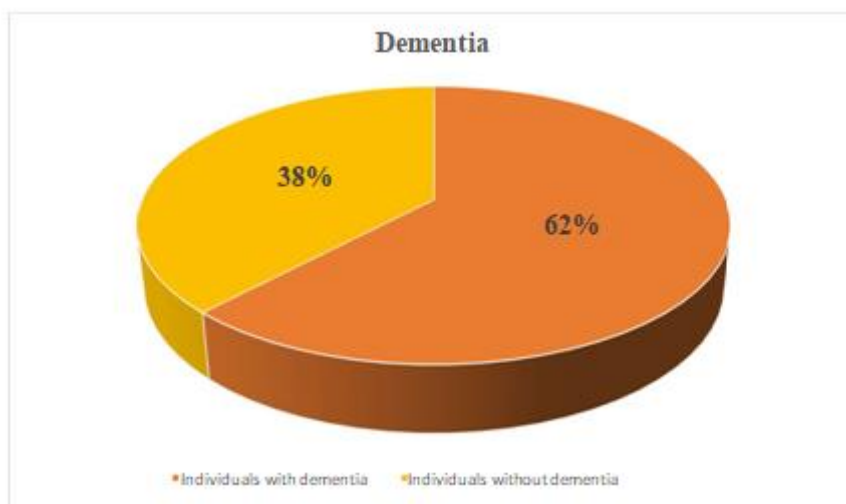


Figure no 2 : Percentage of individuals with Dementia

Table no 2 : Percentage of individuals with Dementia

Dementia	Percentage
Individuals with dementia	62%
Individuals without dementia	38%

Out of 60 subjects, 62% of the individuals have dementia, and the remaining 38% do not have dementia.

The link between type2 diabetes and dementia is multifaceted, involving several physiological and neurological mechanisms. The following physiological and neurological factors contribute to the increased risk of dementia in individuals with Type 2 Diabetes. 1. **Insulin Resistance and Hyperglycaemia: Chronic Hyperglycaemia:** Extended hyperglycaemia can harm blood vessels, particularly those in the brain, resulting in decreased blood flow and possible brain damage. **Advanced Glycation End Products (AGEs):** Excessive glucose levels have the potential to cause the production of AGEs, which can build up in the brain and worsen inflammation and oxidative stress, ultimately resulting in the death of neurons. 2. **Cardiovascular Disease:** Individuals who have type 2 diabetes are frequently at an increased risk of developing cardiovascular conditions, such as hypertension and atherosclerosis. Cardiovascular issues raise the risk of vascular dementia by decreasing blood supply to the brain. 3. **Obesity and Metabolic Syndrome:** Obesity and metabolic syndrome are linked to type 2 diabetes and significantly increase the risk of both dementia and cognitive impairment. Brain health can be adversely affected by inflammation and metabolic abnormalities associated with these diseases. 4. **Insulin Signalling in the Brain:** Insulin Resistance: Insulin signaling is also essential to the brain's ability to develop, repair, and sustain neurons, among other things. These functions can be hampered by insulin resistance in the brain, which can result in cognitive impairment. **Amyloid Plaques:** The development of amyloid-beta plaques, a characteristic feature of Alzheimer's disease, may coincide with insulin resistance. Chronically elevated insulin levels reduce the effectiveness of the enzyme that breaks down amyloid-beta. 5. **Inflammation:** Neuro inflammation can result from the chronic systemic inflammation associated with type2diabetes. Pro-inflammatory cytokines have the ability to penetrate the blood-brain barrier and exacerbate brain inflammation, which is linked to the onset of dementia. 5. **Microglial Activation:** The immune cells called microglia in the brain can be activated by chronic inflammation, which can result in protracted inflammatory reactions that harm synapses and neurons. 6. **Oxidative Stress: Reactive Oxygen Species(ROS):** Oxidative stress is primarily caused by Reactive Oxygen Species (ROS), which are produced excessively in response to elevated blood sugar levels. Oxidative stress has the potential to harm neurons and other biological components, which could lead to cognitive deterioration. 7. **Lipid Dysregulation: Lipid Metabolism:** Dysregulation of lipid metabolism, common in type 2 diabetes, can affect the brain. Altered lipid profiles can disrupt cell membranes and myelin sheaths, impairing neuronal function and communication.

Our study shows that the highest impairment in attention, memory, fluency, language, and visuospatial abilities is observed in individuals with a diabetes duration of more than 20 years, followed by those with a duration of 15 to 20 years. Additionally, our study indicates that dementia is most commonly seen in Type 2

diabetes patients. Individuals who are not diagnosed with dementia early are more vulnerable to associated risk factors. Assessing dementia helps in evaluating the severity of impairment in patients, leading to early diagnosis and better cognitive recovery.

IV. CONCLUSION

It can be concluded that Dementia is prevalent among individuals with Type2 Diabetes Mellitus. Dementia may often be seen in individuals with prolonged type 2 diabetes with duration of 10 to 15 years.

V. LIMITATIONS

The study was confined to a specific area. Small sample size

VI. FUTURE SCOPE

Further studies may look into the severity of Dementia among individuals with type 2 Diabetes mellitus

VII. ACKNOWLEDGMENT

We would like to thank our participants for contributing their time and efforts to participate along with honest responses.

VIII. REFERENCES

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