

Cognitive Impairments and its Associated Risk Factors among Patients with Diabetes Mellitus

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Abstract

Background: Diabetic patients are considered to be more prone to develop cognitive dysfunction and further leading to dementia, hence systematic assessment and identification of risk factors plays a key role. **Aim and objectives:** To study cognitive impairments and its associated risk factors among patients with diabetes mellitus. **Settings and Design:** A hospital-based Multicentre cross-sectional study was conducted. **Methods and Material:** In this study 245 individual medically diagnosed to have diabetes mellitus were recruited according to inclusion and exclusion criteria. Demographic data included age gender and duration of diabetes smoking, BMI, Family history of diabetes and Hypertension *HbA1c* was noted. Cognitive assessment was done using Modified Mini Mental Scale (3MS). Data was collected and subjected to statistical analysis. **Results:** The result shows about 22% had moderate cognitive impairment and associated risk factors can be medications, age, glycaemic control, Hypertension, family history. There is no correlation of Cognition and duration since diagnosed to be diabetic and BSL whereas weak linear relationships exist between cognition and Age and *HbA1c* and strong linear relationship between cognition and BMI in Patients with diabetes. **Conclusions:** Diabetic patients do exhibit Mild cognitive dysfunction with various associated risk factors.

Key-words: Diabetes, smoking, Duration of diabetes, Obesity, Hypertension, Cognitive impairment, *HbA1c*, Modified mini Mental Scale.

Introduction

Diabetes mellitus is autoimmune metabolic disorder, caused by insulin deficiency, is complex in nature and has various factors related to it, long-term complications and co-morbidities can affect the cerebral cortex¹. Islets of langerhans in Pancreas especially the beta (β) cells secrete insulin. Defect in response of insulin causes diabetes mellitus. Type 1 Diabetes Mellitus also called as Insulin-Dependent Diabetes Mellitus (IDDM) or juvenile onset diabetes is caused by destruction of β cells which leads to deficiency of insulin. Type 2 Diabetes Mellitus also called as Non-Insulin Dependent Diabetes

Mellitus (NIDDM) or maturity onset diabetes caused due to impaired insulin secretion or insulin resistance^(1,2,3) Long term diabetes affects central nervous system, peripheral nervous system mainly manifest in the clinical impact of diabetes.⁴

Type 2 diabetes is often associated with increased risk of accelerated cognitive decline and almost two times more susceptible to experience cognitive decline compared to those with normal glucose tolerance. Various researches have suggested that Type 2 diabetes affects cognitive domains like verbal memory, attention and processing speed and executive functions when performing task with change in environment and challenges. Diabetes has also been consistently related with cognitive decrements such as reduced abstract reasoning, complex motor functioning and working memory.¹

Cognitive dysfunction affects memory, learning and attention. In mild cognitive impairment there is cognitive

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dysfunction without affecting the daily activity of life. Person with mild cognitive impairment can self manage their daily routine. Conditions for cognitive dysfunction are hyperglycemia, hypoglycaemia, insulin resistance and insufficiency of insulin in patients with diabetes. In young population due to immediate hypoglycemia, acute cognitive dysfunction can be observed. ⁽⁵⁾

Subjects and Method

Study setup and design: A Multicentered hospital based Cross-sectional study was conducted.

Method: 398 participants had a diagnosis of type 2 diabetes according to the World Health Organization 1999 criteria, and 245 individuals were included in the study. Study was conducted from July 2018 to January 2019. ⁶ Both males and females were included. Subjects who willing five Informed Consent were included in study. An exclusion criterion was patient with Dementia, Alzheimer's disease and any psychological disorder pregnancy. Demographic data included age gender and duration of diabetes, smoking, Family history of diabetes, obesity and Hypertension, BMI, BSL, HBA₁C

was noted. Cognitive assessment was done using Modified Mini Mental Scale (3MS). Data was collected and subjected to statistical analysis.

Results

Demographic data for diabetic patients with mean age 73.22+7.9 , Mean duration since diagnosed to be diabetic was 18+10.82, mean Cognition in diabetics was 75.59+1.6. Also mean BMI was 25.67 +5.351 with Mean BSL and HbA₁c as 190+54.13 and 7.118+0.958 respectively. Table 1 shows that Family history was exhibited in 72.72%, Hypertension in 50%, Diabetic Male were 48% and Females were 52% and diabetic had addiction of Smoking in 68%.

Table 2 shows that there is no correlation of Cognition and duration since diagnosed to be diabetic , and BSL whereas weak linear relationships exist between cognition and Age and HbA₁c and strong linear relationship between cognition and BMI in Patients with diabetes.

Table 1: Percentage of Family History Of Diabetes Cognitive dysfunction Gender Distribution, Hypertension among Diabetics with Cognitive dysfunction.

Risk Factors	Percentage
Family History of Diabetes	72.72%
Hypertension	50%
Gender Male	48%
Female	52%
Smoking	68%

Table 2: Correlation of Age Duration of Diabetes, BMI, BSL, HbA₁c and Cognitive Dysfunction in Patients with Diabetes.

Parameters	Mean+SD	Person correlation (r)
Age	73.22+7.9	0.0175
Duration since diagnosed to be diabetic	18+10.82	-0.03622
BMI	25.67 +5.351	0.1337
BSL	190+54.13	-0.1996
HbA ₁ c	7.118+0.958	0.0846

Discussion

Study showed that 22% had moderate cognitive impairment (MCI). There is no correlation of Cognition and duration since diagnosed to be diabetic whereas weak linear relationships exist between cognition and Age and HbA1c and strong linear relationship between cognition and BMI in Patients with diabetes. Risk factors of smoking family history of diabetes, Hypertension are coexisting with patients with diabetes.

The prevalence in urban Kerala of Mild cognitive impairment in patients with diabetes was 26.06%. This prevalence is reported from different areas of the world varies widely between 3% and 42%. Previous researches from India estimated prevalence between 15% and 33%⁽⁷⁾

A research showed that Deficits in memory is correlated with decrease in gray matter density and reduced glucose metabolism in the regions of orbital and prefrontal cortex, temporal cortex (middle gyrus, parahippocampus, and uncus), and cerebellum. Both Type 1 and type 2 diabetes are associated with impaired cognition; the current statistically analyzed data suggests a stronger association of cognitive decline with T2DM. Early Cognitive impairment is observed in individuals who have impaired blood fasting glucose.⁽⁸⁾

The various studies have shown that prevalence of diabetes is higher in men than women, but there are more women Suffering with diabetes than men in recent years. Similar results have been observed related to the proportion of females was much higher than the males suffering with diabetes in our study. Studies have truly delineated that cognition impairment correlates with the glycaemic control as well as the duration of diabetes.

Mohammed Abdul Hannan Hazari and others concluded in the study that due to long duration specifically exceeding 5 years of onset of diabetes showed prominent decline in cognition in as Diabetes is considered a potential atherogenic factor. Also hypertension along with Diabetes further increases the risk of cognitive decline.⁽¹⁰⁾ In type 2 diabetes mellitus, chronic hyperglycemia can be cause of cognitive decline.⁽¹⁰⁾

Medha N. Munshi concluded in the study that poor glycaemic control i.e. Hypoglycemia and chronic hyperglycemia can factor that can lead to cognitive dysfunction better management of Diabetes is required

to prevent cognitive decline in older adults.⁽⁵⁾

E. van den Berg and others concluded in their study that obesity, hypertension, and dyslipidaemia are features that have risk of cognitive dysfunction in younger old. At the age up to 75, increased cholesterol levels and increased BMI are related with accelerated cognitive decline up.⁽¹¹⁾

In the general population, studies on other risk factors for accelerated cognitive decline were hypertension and obesity. Hypertension has been suggested to be an important factor of impaired cognition in diabetes. A similar result is seen in this study that A higher HbA1c level was largely unrelated to cognitive dysfunction.⁽¹¹⁾

Omorogieva Ojo and others in their study concluded that neurotransmitter acetylcholine functions for cognition and memory formation. Dysfunction in insulin production and insulin resistance could lead to a decrease in acetylcholine levels which may have impact on cognition and memory. Diabetes is a risk factor for decline in cognitive. Hyperglycaemia and hypoglycaemia may result from poor self management of diabetes which can lead to cognitive decline.⁽¹²⁾

Insulin crosses the blood brain barrier and binds with insulin receptor. Insulin plays an important role in cognitive function and also in food intake. Insulin is present in abundance in cerebral cortex and hippocampus which play important role in memory. Due to insulin resistance there is decrease in insulin receptors and decrease insulin in brain. It result impairment in cognition For some time, cognitive decline has been reported in patients receiving insulin therapy A recent study showed that up to half of all cases of Alzheimer's disease are attributable to potentially modifiable risk factors – diabetes, midlife hypertension, midlife obesity, smoking, depression, low education level and physical inactivity. Most of these risk factors also contribute to the incidence or progression of diabetes mellitus.⁽¹³⁾

Conclusion

Study concludes that 22% Diabetic patients had moderate cognitive impairment (MCI) wherein they exhibited no correlation between Cognition and duration since diagnosed to be diabetic. Furthermore there exist a weak linear relationships exist between cognition, Age and HbA1c and strong linear relationship between cognition and BMI in Patients with diabetes. The other modifiable and non modifiable risk factors were smoking,

family history of diabetes, Hypertension which coexist in patients with diabetes contributing towards potential cognitive decline irrespective of the age of the patients.

Acknowledgement: We express sincere gratitude towards Dr Shreepad Bhatt for his support and cooperation for referring patients from multiple Diabetic clinics. We would also like to thank Department of Physiotherapy Pune , teaching Non teaching faculty for their support during the research work.

Conflict of Interest: Nil

Funding : Nil

Ethical Clearance: Ethical clearance was obtained from institutional ethical committee.

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