

To Assess the Prevalence of Cognitive Impairment in Type II Diabetes Mellitus: An Observational Study

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ABSTRACT

Introduction: Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia that affects various body systems. Elevated blood glucose levels cause brain malfunction, sorbitol which damages blood vessels, and degeneration of the nerves that can lead to dementia or cognitive impairment. Cognitive impairment can result in nonadherence of patients to diabetes treatment, such as medication, diet and exercise.

Purpose: The purpose of this study was to assess the prevalence of cognitive impairment in type II diabetes mellitus.

Methodology: 50 participants of age group 30 - 60 years, both male and female were included in this study. Cognitive impairment was assessed with the English version of the Montreal Cognitive Assessment (MoCA) tool. The MoCA scoring according to Dementia and Driving Safety: A clinical guideline, Version 3, 2014.

Result: Among the 50 patients who were assessed, 24 (48%) were cognitively impaired. 20 (40%) of the subjects were age group of 51-60 years, and males participants 11(22%) outnumbered females 9 (18%). The majority of patients (40%) had diabetes type II for < 2 years.

Conclusion: There was strong correlation found between Type II DM and cognitive impairment.

Key Words: Prevalence, Cognitive impairment, Diabetes mellitus Type II, Montreal Cognitive assessment (MoCA)

INTRODUCTION

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia that affects various systems of the body. For this progressive, and incurable condition, the best scenario after diagnosis is good metabolic control and risk factor management to forestall vascular and neuropathic complications.^[1] The prevalence of both type I and type II Diabetes mellitus is increasing worldwide, the prevalence of type II DM is much more rising rapidly, especially in developing countries like India and China because of

increasing obesity, reduced activity levels and also because of the ageing of the population.^[2] People with diabetes often develop diverse microvascular, macrovascular and neuropathic complications that affects the quality of life.^[3] Diabetes mellitus (DM) is a worldwide major pathological condition due to its high prevalence, negative impact on lifespan and quality of life, as well as the extremely high costs requires.^[4] Worldwide increasing population and increasing sedentary lifestyle have led to rise in diabetes, with a 72% increase in disease projected by 2030.^[5]

Diabetes type II is caused by a combination of resistance to insulin action and an inadequate compensatory insulin secretory response.^[6] The impaired insulin metabolism in diabetic patients results in widespread morbidities involving the renal, retinal, cardiovascular, and peripheral nervous systems^[7] and also affects cognition.^[8] Elevated blood glucose levels cause brain malfunction, promote the synthesis of sorbitol, which blood vessels damages and degeneration of the nerves.^[9] Oxidative stress, microvascular vasculopathy, inflammation, dyslipidemia, and microalbuminuria are other key mediators resulting in neuropathology that can lead to cognitive impairment or dementia.^[10]

Patients are said to be cognitively impaired when they have difficulties in remembering, learning new things, concentrating, or making decisions that affects daily life. Cognitive impairment, especially for those people who chronic diseases, is likely to be an obstacle to providing appropriate medical treatment, as patient understand need of treatment, regular follow-up and self-care can be limited by the cognitive impairment.^[11] Cognitive impairment might result in nonadherence with medication, diet and exercises.^[12] Cognitive impairment has also increased the risk of major cardiovascular events and all-cause mortality.^[13]

Studies about the relationship between cognitive impairments and diabetes mellitus are inconclusive because of inconsistent reports, in findings may be attributable to differences in study design, study subjects, duration or severity of diabetes, and the tools used for assess cognitive impairments.^[14] Montreal Cognitive Assessment (MoCA), was developed to assess the mild cognitive impairments, but few studies have reported using the MoCA in community settings.^[15] A pilot study from Canada reported the MoCA appears to be a better screening tool than the Mini-Mental State Examination for

detecting mild cognitive impairment in the diabetic population.^[16]

Diabetes – related cognitive impairment seriously challenge the demand for future health resources because of the increasing prevalence of T2DM and prolonged life-span. Thus, the purpose of the study was to assess the prevalence of Cognitive Impairment in Type II Diabetes Mellitus. So that effective treatment plan can be done.

Aim of the study is to assess the severity of cognitive impairments in type II diabetes mellitus.

Objectives of the study was, (i) To assess the severity of duration in Type II DM. (ii) To assess the severity of cognitive impairments in Type II DM. (iii) To assess the severity of duration on cognitive impairments in Type II DM.

MATERIALS AND METHOD

Source of collection of data: After obtaining Institutional ethical committee clearance, 50 subjects (male and females) were selected for this study base on inclusion and exclusion criteria.

Study design: A cross-sectional study

Sampling method: Samples were taken by simple random sampling method

Materials used: Pen, paper, pencil, writing pad, MoCA tool

INCLUSION CRITERIA

- Subjects diagnosed with Type II DM > 3 months
- Age group of 30 - 60 years, both male and female
- According to American Diabetes Association (ADA) guidelines, Fasting Blood Sugar \geq 126 mg/dL or HbA1c \geq 6.5 %
- willing to participated

EXCLUSION CRITERIA

- Subjects who had Metabolic diseases (HTN, Thyroid), Neuro-psychological disorder, Systemic illness, any other chronic diseases and pregnant females.

Sampling Procedure: Initial contact was made in the community and suitable subjects were identified. Consent formed was taken from those who were willing to participate in the study. The purpose of the study was explained to the participants, and they were informed that refusal to participate would not affect the ongoing treatment or outcome adversely.

Demographic details of the subjects were collected using socio-demographic and clinical data proforma designed especially for the study. Investigations like hemogram, random blood sugar, fasting blood sugar, postprandial blood sugar, and glycosylated hemoglobin, which were available, were recorded. The Cognitive impairment was assessed through the administration of the English Version of the MoCA. The MoCA assesses 7 cognitive domains:

visuospatial/executive (5 points), naming (3 points), memory (5 points for delayed recall), attention (6 points), language (3 points), abstraction (2 points), and orientation (6 points); the upper score limit is 30 points. One point is added if the subject has ≤ 12 years of education. The cutoff value is 26. A score ≥ 26 is considered normal. In this study scoring done according to Fisher, Mark, Thomson, Sue. (2014) Dementia and Driving Safety: A clinical guideline, Version 3. Where, the cutoff value is 27. A score > 26 is considered normal. A score between 18-26 is considered mild cognitive impairment. A score between 11-17 considered mild dementia. A score 6-10 considered moderate dementia. A score < 6 considered severe dementia.

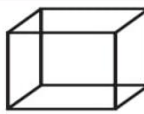
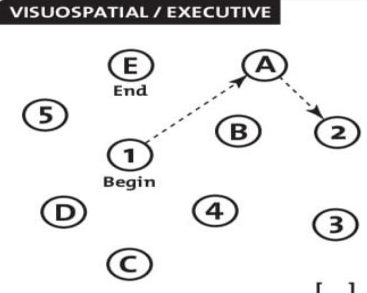
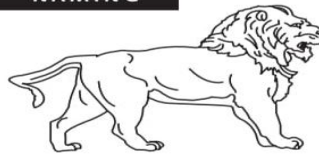
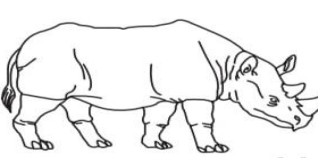
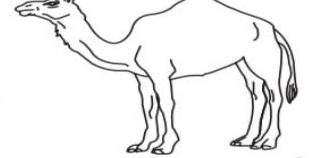
MONTREAL COGNITIVE ASSESSMENT (MOCA)		NAME :		Date of birth :		POINTS		
		Education :		DATE :				
		Sex :						
VISUOSPATIAL / EXECUTIVE		 Copy cube []		Draw CLOCK (Ten past eleven) (3 points) [] Contour [] Numbers [] Hands		___/5		
 [] []						___/5		
NAMING		 []		 []		 [] ___/3		
MEMORY	Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.	FACE	VELVET	CHURCH	DAISY	RED	No points	
ATTENTION		Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order [] 2 1 8 5 4		Subject has to repeat them in the backward order [] 7 4 2		___/2		
Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors		[] FBACMNAAJKLBAFAKDEAAAJAMOF AAB		___/1				
Serial 7 subtraction starting at 100		[] 93	[] 86	[] 79	[] 72	[] 65	___/3	
LANGUAGE		Repeat : I only know that John is the one to help today. []		The cat always hid under the couch when dogs were in the room. []		___/2		
Fluency / Name maximum number of words in one minute that begin with the letter F		[] _____ (N ≥ 11 words)		___/1				
ABSTRACTION		Similarity between e.g. banana - orange = fruit [] train - bicycle [] watch - ruler		___/2				
DELAYED RECALL	Has to recall words WITH NO CUE	FACE	VELVET	CHURCH	DAISY	RED	Points for UNCUED recall only	
Optional	Category cue	[]	[]	[]	[]	[]		
	Multiple choice cue	[]	[]	[]	[]	[]		
ORIENTATION		[] Date	[] Month	[] Year	[] Day	[] Place	[] City	___/6
© Z.Nasreddine MD Version November 7, 2004		www.mocatest.org		Normal $\geq 26 / 30$		TOTAL ___/30 Add 1 point if ≤ 12 yr edu		

Table 1 : The Montreal Cognitive Assessment (MoCA)

STATISTICAL ANALYSIS

The data were analyzed for statistical significance by using the Microsoft Excel 2007.

RESULT

The study sample consisted of 50 participants with mean age 45.12 ± 9.25 years.

Among the 50 (26 males and 24 females) patients who were assessed, 24 (48%) (10 males and 14 females) were cognitively impaired (score < 26 on the MoCA) [Table 2]. The highest mean score was in the domain of attention 194 (64.67%), while the lowest mean score was in the domain of naming 8 (5.33%) [Figure 1].

Table 2: Demographic variables and their correlation with cognitive dysfunction

Variable	All Patients (n=50), n (%)	Cognitive dysfunction Present (n=24), n (%)	Cognitive dysfunction Absent (n=26), n (%)
Age (years)			
31-40	18 (36)	6 (25)	12 (46.15)
41-50	12 (24)	6 (25)	6 (23.08)
51-60	20 (40)	12 (50)	8 (30.77)
Gender			
Male	26 (52)	10 (41.67)	16 (61.54)
Female	24 (48)	14 (58.33)	10 (38.46)
Duration of Disease			
<2 years	20 (40)	6 (25)	14 (53.85)
2-5 years	14 (28)	7 (29.17)	7 (26.92)
>5 years	16 (32)	11 (45.83)	5 (19.23)

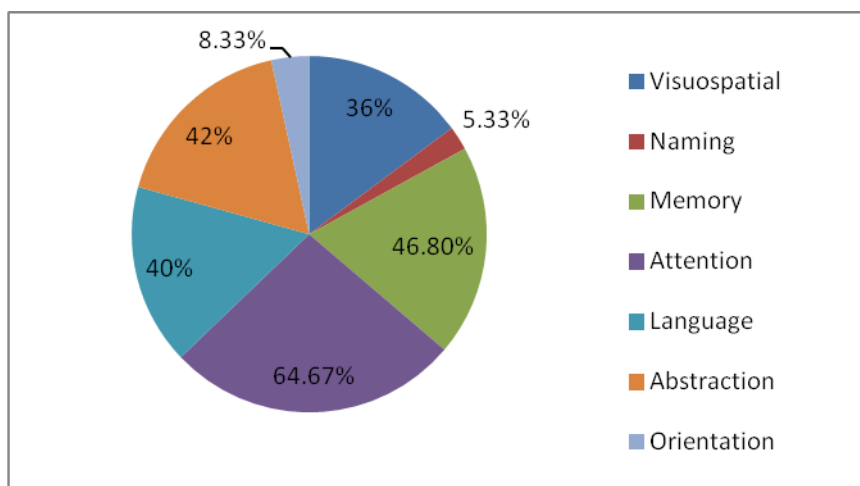


Figure 1 : Various types of cognitive impairments observed in %

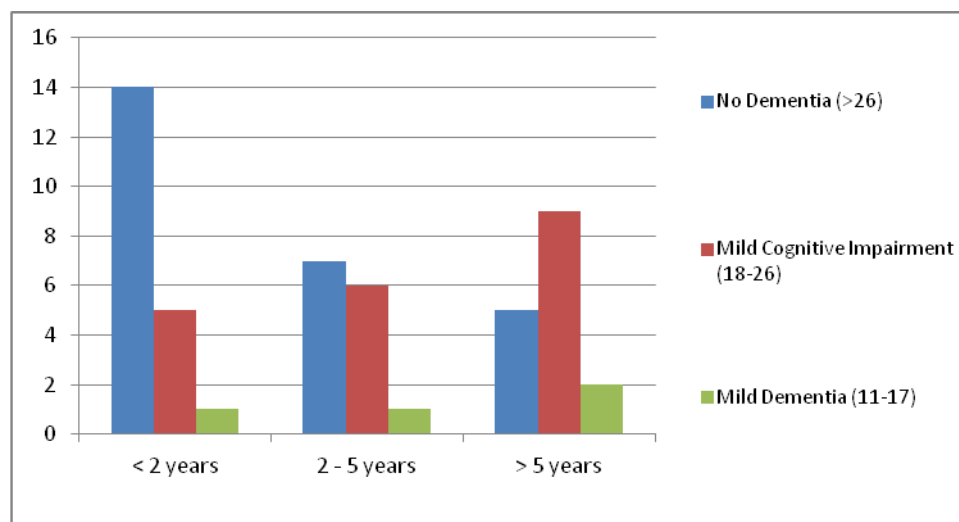


Figure 2 : correlation found between duration of T2DM and Cognitive impairments

There was a correlation found between duration of T2DM and Cognitive impairments [Figure 2]. Participants with <2 years duration had no dementia 14 (70%), mild cognitive impairment 5 (25%) and mild dementia 1 (5%). 2 – 5 years duration had no dementia 7 (50%), mild cognitive impairment 6 (42.86%) and mild dementia 1 (7.14%). >5 years duration had no dementia 5 (31.25%), mild cognitive impairment 9 (56.25%) and mild dementia 2 (12.5%).

Among the participants, 20 (40%) were 51-60 years of age, females 9 (45%) and males 11 (55%). At this age range maximum participants 12 (60%) was cognitive impaired. Thus, there is an association of age with cognitive dysfunction.

Among those cognitive impaired a high proportion of females 14 (58.33%) had cognitive dysfunction compared to males 10 (41.67%) respectively.

DISCUSSION

T2DM is associated with accelerated cognitive decline [17] and poor glycemic control is implicated in the development of cognitive dysfunctions. [18]

Cognitive domains that have been studied in T2DM include memory, psychomotor speed, visuospatial functions, frontal executive functions processing speed, verbal fluency attention and complex motor functions. [19] The authors concluded that the most consistently reported measures were impairment in verbal memory and processing speed with preservation of functions including visuospatial function attention, semantic memory and language. [20] In the present study the domain, attention was highly affected among subjects, however, naming was least affected.

More than 55% of females had cognitive impairment in this study. This finding supported to the Salthouse study. [21] Ferris et al [22] showed cognitive decline to be more prevalent among females.

Ruis et al [17] reported that modest cognitive decrements were identifiable at the early stage of T2DM. They also postulated that diabetes duration seemed to be linked to the effect sizes of the studies. The longer duration of diabetes, the higher the noted effect size.

In our study, there was higher cognitive impairment in subjects with more than 5 years of T2DM.

Therefore, the study supports to assess the baseline prevalence is the first step in designing programs to address any health issue. Health education pertaining to cognitive decline, early identification, and management can be effective only when patients and caregivers are aware about importance of cognition and their treatment.

CONCLUSION

There was strong correlation found between Type II DM and cognitive impairment, which is highly prevalent. Evidences generated by various studies suggest that cognitive dysfunction should be listed as one of the many complications of diabetes.

Limitation Of Study

This study was limited by its small sample size because of COVID 19 pandemic situation, and unequal distribution of participants.

Future Study

Further research can be carried out by larger sample size, on difference between rural and urban area and also include education, occupation, socio-economical status, and BMI.

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Ethical Approval: Approved

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