

Original Research

Association of Cognitive Impairment and Type 2 Diabetes Mellitus

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ABSTRACT:

Background: Diabetes mellitus is a complex metabolic disease manifested in the form of hyperglycemia and glucose intolerance. The present study was conducted to assess compare the prevalence of mild cognitive impairment between non-diabetics and type 2 diabetics. **Materials & Methods:** 60 type II diabetes patients and 60 healthy subjects of both genders were subjected to Mini Mental State Examination (MMSE) score and Montreal Cognitive Assessment (MoCA). **Results:** Group I had 40 males and 20 females and group II had 35 males and 25 females. Mild cognitive impairment was seen among 28 in group I and 18 in group II and no MCI was seen in 32 in group I and 42 in group II. The difference was significant ($P < 0.05$). **Conclusion:** Type 2 diabetes mellitus has a significant statistical association with mild cognitive impairment.

Key words: cognitive impairment, diabetes mellitus, hyperglycemia

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INTRODUCTION

About 451 million people have diabetes worldwide, and the number is increasing causing a major public health burden. Diabetes mellitus is a complex metabolic disease manifested in the form of hyperglycemia and glucose intolerance and can have devastating outcomes on various organs in the body. Although the implications of diabetes on the peripheral nervous system have been well established, its effects on the central nervous system are ambiguous. One of the complications of diabetes related to the central nervous system is cognitive dysfunction which isn't well recognized and is sparsely addressed.¹

However, the role of diabetes mellitus (DM) as a risk factor for cognitive decline in later life has received little epidemiological attention until recently, despite the high prevalence of diabetes in older populations and several potential mechanisms, vascular and otherwise, by which it may cause cognitive deterioration.²

Mild cognitive impairment (MCI) is a stage in-between the cognitive decline of caused by normal aging and the more severe decline as that caused by dementia.³ It involves deficits with memory, language, learning, intellect etc that are far more pronounced than those caused by age related changes. Since MCI is frequently considered as a transitional stage between cognitive decline caused by aging and Alzheimer's disease, hence identification of the associated risk factors could be useful.⁴ Among the various neuropsychological tests used, the mini-mental state examination (MMSE) and the Montreal Cognitive Assessment (MoCA) are the most widely used tests for screening. The Mini-Mental State Examination (MMSE) or Folstein test is extensively used to measure or assess MCI during clinical examination.⁵ The present study was conducted to assess compare the prevalence of mild cognitive impairment between non-diabetics and type 2 diabetics.

MATERIALS & METHODS

The present study was conducted among 60 type II diabetes patients and 60 healthy subjects of both genders. All were informed regarding the study and written consent was obtained.

Demographic data of each subject was recorded. All were subjected to Mini Mental State Examination (MMSE) score. Interpretation of MMSE: Severity:

24-30 - No cognitive impairment 18-23 - Mild cognitive impairment 0-17 - Severe cognitive impairment. They were also subjected to Montreal Cognitive Assessment (MoCA). Interpretation of MoCA: Severity: ≥ 26 - No cognitive impairment and < 26 - Cognitively impaired. Results were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of subjects

Groups	Group I	Group II
Status	Diabetics	Control
M:F	40:20	35:25

Table I shows that group I had 40 males and 20 females and group II had 35 males and 25 females.

Table II Association between the presence of T2DM and MCI

Parameters	Group I	Group II	P value
MCI	28	18	0.05
No MCI	32	42	0.04

Table II, graph I shows that mild cognitive impairment was seen among 28 in group I and 18 in group II and no MCI was seen in 32 in group I and 42 in group II. The difference was significant ($P < 0.05$).

Graph I Association between the presence of T2DM and MCI

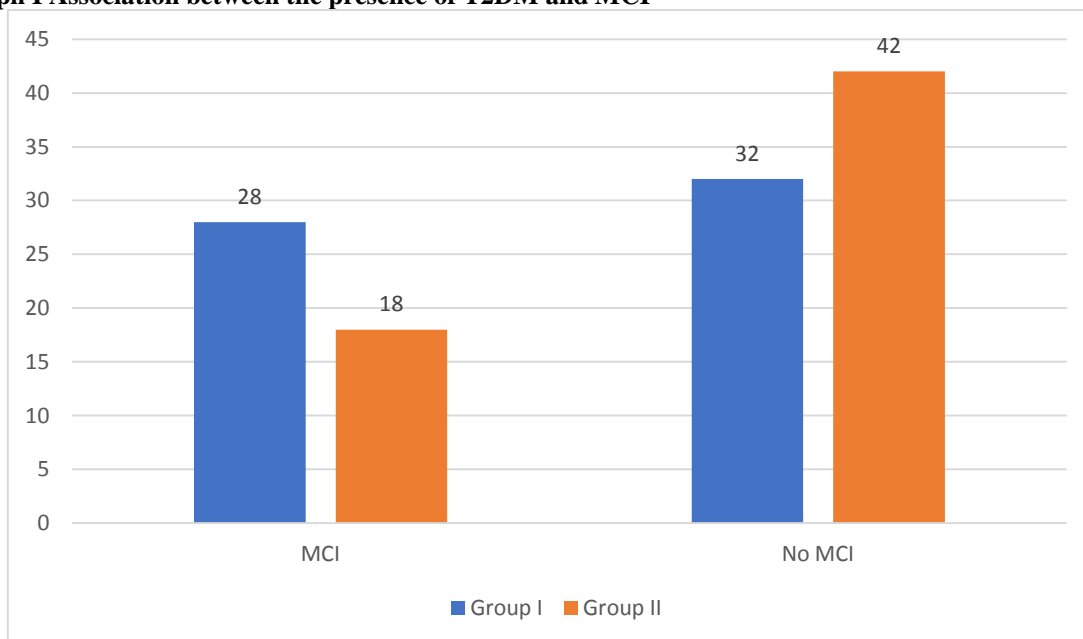


Table III Correlation of MCI with type II diabetes

Correlation	r	P value
Duration of diabetes	0.89	0.04

There was positive correlation of MCI and duration of diabetes ($r = 0.89, p < 0.05$).

DISCUSSION

Type 2 diabetes mellitus (T2DM) is characterized by relative insulin deficiency and insulin resistance, and obesity and sedentary lifestyle are generally considered to be the major risk factors.⁶ According to changes in socioeconomic factors and increased practice of unhealthy lifestyle habits, the prevalence of diabetes is increasing in developing and developed countries. T2DM is associated with cognitive decline,

and patients with diabetes the patients exhibit worse cognitive ability and more abnormalities on brain imaging than individuals without diabetes.⁷ The prevalence of mild cognitive impairment (MCI) is particularly higher in T2DM patients older than 65 years. Multiple long-term epidemiological studies have implicated T2DM as a risk factor for cognitive dysfunction and dementia in the elderly. The mechanisms of cognitive function decline and brain

structural abnormalities in T2DM patients remain incompletely understood.⁸ However, research has identified particular risk factors that promote the occurrence of MCI in T2DM patients, including vascular risk factors, macrovascular diseases, microvascular complications, poor glycemic control, hyperinsulinemia, increased oxidative stress, accumulation of amyloid-beta peptide and tau hyperphosphorylation, and nerve growth factor deficiency.⁹ The present study was conducted to assess compare the prevalence of mild cognitive impairment between non-diabetics and type 2 diabetics.

In present study, group I had 40 males and 20 females and group II had 35 males and 25 females. Rama et al¹⁰ in their study 50 patients with T2DM and 50 age and sex matched non-diabetic controls were selected. The Mini-Mental state examination (MMSE) and the Montreal Cognitive Assessment (MoCA) were conducted. If either of the screening instruments suggested MCI, the patient was then subjected to an extensive medical examination conducted by qualified medical clinicians blinded to the MMSE and MoCA scores for a more detailed diagnosis of MCI. Chi square test revealed a statistically significant correlation between T2DM and MCI. Years of illness was found to predict 5% of the variance in MMSE score and 14% of the variance in MoCA score.

We found that mild cognitive impairment was seen among 28 in group I and 18 in group II and no MCI was seen in 32 in group I and 42 in group II. There was positive correlation of MCI and duration of diabetes ($r = 0.89$, $p < 0.05$). Sun et al¹¹ investigated the risk factors for cognitive impairment in Chinese type 2 diabetes mellitus (T2DM) patients of advanced age and to identify effective biomarkers of mild cognitive impairment (MCI) in these patients. T2DM patients ($n = 120$) aged 50–70 years were divided into groups with impaired (mild, moderate, and severe) and normal cognitive function based on Montreal Cognitive Assessment and Mini-Mental State Examination scores. Age, educational level, duration of diabetes, fasting blood glucose (FBG), HbA1c, total cholesterol (TC), triglyceride (TG), and 24-hour urine protein were significantly associated with cognitive impairment in T2DM patients of advanced age. The severity of fundus retinopathy and the incidence of macrovascular disease also differed significantly among the groups ($P < 0.05$). Metabolomics analysis suggested that increased levels of glutamate (Glu), phenylalanine (Phe), tyrosine (Tyr), proline (Pro), and homocysteine (Hcy) and a decreased level of glutamine (Gln) were significantly associated with cognitive impairment in the T2DM patients ($P < 0.05$). Receiver operating characteristic curve analysis demonstrated that Glu, Gln, Phe, and Pro levels were significant predictors of cognitive impairment in the T2DM patients.

Stewart et al¹² found evidence of cross-sectional and prospective associations between Type 2 DM and

cognitive impairment, probably both for memory and executive function. There is also evidence for an elevated risk of both vascular dementia and Alzheimer's disease in Type 2 DM albeit with strong interaction of other factors such as hypertension, dyslipidaemia and apolipoprotein E phenotype. Both vascular and non-vascular factors are likely to play a role in dementia in diabetes. Current classification structures for dementia may not be adequate in diabetes, where mixed pathogenesis is likely.

CONCLUSION

Authors found that type 2 diabetes mellitus has a significant statistical association with mild cognitive impairment.

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