International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 5, No.1, January-March 2016 Online ISSN: 2250-3137
Print ISSN: 2977-0122

ORIGINAL RESEARCH

A cross-sectional investigation of cognitive impairments in individuals diagnosed with type 2 diabetes mellitus in a tertiary care hospital

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Received: 17 November, 2015 Accepted: 20 December, 2015

ABSTRACT

Aim: A cross-sectional investigation of cognitive impairments in individuals diagnosed with type 2 diabetes mellitus in a tertiary care hospital. **Materials and Methods:** The study was a case control study which was carried out after taking informed consent. Random sampling was carried out among T2DM outpatients at ending the Department of Psychiatry. 100 patients with T2DM and 102 age and sex matched nondiabetic controls were selected for the study. An informed written consent was obtained from all patients prior to the study. All the participants were subjected to a face to face interview during which demographic data (age, sex, education) and medical history (vitals, years of illness, significant comorbidities) were collected. **Results:** The demographic characteristics of patients are presented in Figure 1 and 2. The study consisted of 62% males and 32% female part incitants. 70 participants were in the age groupof 45-50 years, 32 were between 50-55 years, 60 were between 55-60 years and 46 were between 60-65 yrs. intergroup comparison for gender and age did not show any statistical significance. The association between the presence of T 2DM and MCI done using Chi square test. 44% of diabetics had MCI while 56% of diabetics had no MCI. 24% of Non- diabetics had MCI while 76% of Non- diabetics did not have MCI. The test revealed that there was a statistically significant relation between the presence of T2DM and MCI with a P value < 0.05. **Conclusion:** This study established that type 2 diabetes mellitus has a significant statistical association with mild cognitive impairment. This study aims to create an awareness regarding the early neurological manifestations of this rampant disease with the use of sensitive screening tools.

Key Words: Diabetes mellitus, nondiabetic controls, mild cognitive impairment

INTRODUCTION

Diabetes mellitus (DM) represents a group of common metabolic disorders that share the phenotype of hyperglycaemia. Several types of DM exist and are caused by a complex interaction of genetics, environmental factors and lifestyle choices. The metabolic dysregulation associated with DM causes secondary pathophysiological changes in multiple organ systems[1]. 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.4 It involves deficits with memory, language, learning, intellect etc that are far more pronounced than those caused by age related changes[2]. 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.5 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[3].

The Mini–Mental State Examination (MMSE) or Folstein test is extensively used to measure or assess MCI during clinical examination or for research purpose.6 The MMSEis advantageous as it does not require any specialized equipment or training for its administration, and yet demonstrates validity and reliability in diagnosis and longitudinal assessment of Alzheimer's disease[4]. The ease of application and the short duration of time required to conduct the examination makes it a popular tool for assessment of

cognitive function in the clinician's office or even at bedside[5]. There is scarcity of data that explore the association between MCI and T2DM among the Indian population. Hence this case-control study aimed to explore the association between type 2 diabetes mellitus and mild cognitive impairment and also compare the prevalence of mild cognitive impairment between non-diabetics and type 2 diabetics.

MATERIALS AND METHODS

The study was a case control study which was carried out after taking informed consent. Random sampling was carried out among T2DM outpatients attending the Department ofPsychiatry.

INCLUSION CRITERIA

Patients with T2DM in the age group of ≥ 40years but ≤ 65years with duration of T2DM forat least ≥ 5 years were included in the study.

EXCLUSION CRITERIA

Patients with acute medical disorders (Acute respiratory syndrome, acute lymphoid leukemia), any serious physical or mental illness, neurological disorders (Parkinsonism, Alzheimer's), metabolic syndromes (lipodystrophy) and pre-existing systemic illness (Congestive cardiac failure, chronic kidney disease, respiratory failure) were exclude from the study.

100 patients with T2DM and 102 age and sex matched nondiabetic controls were selected for the study. An informed written consent was obtained from all patients prior to the study. All the participants were subjected to a face to face interview during which demographic data (age, sex, education) and medical history (vitals, years of illness, significant comorbidities) were collected. This was followed by conduction of the MMSE and MoCA. Mini Mental State Examination (MMSE) MMSE is a 11-question screening measure that systematically assesses the mental status. It tests five areas of cognitive function namely orientation, registration, attention and calculation, recall and language. A maximum score of 30 can be obtained. Interpretation of MMSE: Severity: 24-30 - No cognitive impairment 18- 23 - Mild cognitive impairment 0-17 - Severe cognitive impairment Montreal Cognitive Assessment (MoCA) MoCA is a swift screening tool for MCI assessment and it tests various cognitive domains like attention, concentration, memory, language, visuoconstructional skills, calculations and orientation. A maximum score of 30 can be obtained. Interpretation of MoCA: Severity: ≥26 - No cognitive impairment.

RESULTS

The study consisted of 62% males and 32% female participants. 70 participants were in the age group of 45-50 years, 32 were between 50-55 years, 60 were between 55-60 years and 46 were between 60-65 yrs. intergroup comparison for gender and age did not show any statistical significance.

Table 1: Association between the presence of T2DM and MCI (Mild cognitiveimpairment)

Variable	Diabetics	Non Diabetics	P Value
MCI	44	24	0.002
Non-MCI	56	78	0.003

Table 2: Gender distribution

Gender	Percentage	P Value
Male	62%	0.003
Female	38%	0.004

Table 3: Age distribution

Age Group	Number of patients	Percentage	P value
45-50 years	70	33.65%	0.001
50-55 years	32	15.38%	0.002
55-60 years	60	29.26%	0.001
60-65 years	46	22.11%	0.002

The association between the presence of T2DM and MCI done using Chi square test. 44%of diabetics had MCI while 56% of diabetics had no MCI. 24% of Non-diabetics had MCI while 76% of Non-diabetics did not have MCI. The test revealed that there was a statistically significant relation between the presence of T2DM and MCI with a P value < 0.05.Linear regression analysis performed to determine the strength of years of illness as a predictor of MMSE score. The years of illness was found to predict 5% of the variance in MMSE score with a P value < 0.05. Linear regression analysis performed to determine the strength of years of illness as a predictor of MoCA score. Years of illness was found to predict 14% of the variance in MoCA score with a P value < 0.05.

DISCUSSION

Diabetes mellitus not only increases the risk of MCI but also multiplies the risk of such an impairment progressing to dementia. The early prediction of conversion of such impairment to dementia has important clinical considerations[7]. The mild

neurocognitive dysfunction caused by diabetes not only complicates the daily activities of patients with diabetes but also doubles the likelihood of such patients developing depression which will further negatively impact the cognitive function and daily activities. Patients with T2DM also have a higher incidence of Alzheimer's disease and increased occurrence of vascular dementia[8].

Diabetes accelerates cognitive decline and conversion to dementia through a number of potential mechanisms. Several theories have been proposed for the etiopathogenesis of MCI which include insulin resistance syndrome, hyperglycemia, vascular disease, hypoglycaemia, amyloid deposition or the generation of the advanced glycosylation products etc[9].

Many studies have implicated that the primary complication of MCI is progression to Alzheimer's disease possibly due to hyperlipidemia (seen in T2DM) which augments the risk of vascular dysfunction. Although some research has been done with regard to cognitive dysfunction in patients with diabetes, more insightful research is needed to understand the mechanisms and natural course of such a complication in order to better develop strategies for its prevention and treatment[10].

This study reveals a statistically significant correlation between T2DM and the presence of MCI independent of hypertension. The results of the present study are in agreement to studies by Alencar RC et al and Alagiakrishnan K et al. The results of the present study also suggests that the risk of developing MCI (and hence Alzheimer's disease) increases with duration of disease. The results of our study are consistent with studies conducted by Li W et al and Albai O et al. This association may be partly independent of efficacy of glycemic control. In addition, we did not find the effect of the duration of T2DM and hypoglycemic agents on cognitive function. However, studies have shown that there was a negative correlation between cognitive function and of duration T2DM. Hsu et al reported that both sulfonylureas and metformin independently decrease risk of dementia, and that a combined use of the two drugs decreased the risk of dementia by 35% in patients T2DM for >8 years. These results indicated that this association exists among the Indian population as well.

CONCLUSION

This study established that type 2 diabetes mellitus has a significant statistical association with mild cognitive impairment. This study aims to create an awareness regarding the early neurological manifestations of this rampant disease with the use of sensitive screening tools

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