Original Article

Risk factors for cognitive dysfunction among patients with type II diabetes mellitus attending tertiary care centre in south India

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Abstract

Introduction: Diabetes mellitus is a growing epidemic which has now spread to the developing countries. Studies have established links between adults with Type II diabetes and early impairment of cognitive function. The present study was conducted to estimate the prevalence of cognitive dysfunction among type II diabetics and to establish the risk factors associated with the same. **Materials and Methods:** This prospective cross sectional study was carried out at a University teaching hospital in semi urban south India. 62 patients with diabetes mellitus attending diabetic clinic of the general medicine department were recruited for the study. After obtaining informed consent, their baseline demographic details were documented and each patient was subjected to a Mini Mental Scale Scoring test. Test scores were then analyzed and possible risk factors for cognitive decrements were examined with multivariate linear regression. **Results:** The mean MMSE in the studied population was found to be 23.3±6.4. The lowest score obtained was 16. The risk factors associated with developing cognitive impairment were found to be poor glycemic control and alcoholism **Conclusion:** Cognitive impairment was found in 46% of all patients with diabetes mellitus. Risk factors associated with cognitive dysfunction are poor glycemic control and alcoholism. The duration of diabetes does not have significant effect on the cognitive function.

Keywords: Type II diabetes mellitus, cognitive dysfunction, MMSE, HbA1c, alcoholism.

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INTRODUCTION

In Type II diabetes, the deleterious effects such as nephropathy, neuropathy, retinopathy and macrovascular complications have been well recognized. However, a new and under-recognized complication is cognitive dysfunction. Type II diabetes is being increasingly associated with decline in cognitive function, and an increased risk of dementia. Studies have shown that, compared to people without diabetes, people with diabetes have a greater rate of worsening cognitive function and therefore it has been proposed that cognitive dysfunction be added to the list of chronic complications of diabetes[1].Although the exact mechanism by which cognitive decline occurs in Type II diabetes is not well understood, some of the factors which have been attributed to this include frequent hypoglycemia, vascular disease, hyperglycemia as well as insulin resistance. There are various neurocognitive impairments which have been linked to diabetes mellitus. Decreases in psychomotor speed, frontal lobe/executive function, verbal memory, processing speed, complex motor functioning, working memory, immediate recall, delayed recall, verbal fluency, and attention [2-9] have all been demonstrated in various studies. Patients with mini-mental status exam scores less than 23 were shown, in a study by Sinclair *et al*, to have difficulties in self care and

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ability to perform activities of daily living [10].Bruce *et al* also found that 11.3% of elderly patients with type 2 diabetes had cognitive impairment. Many mechanisms have been considered for an association between diabetes and cognitive dysfunction. In their review, Biessels *et al*. [12] have attributed atherosclerosis, microvascular disease, advanced protein glycation and oxidative stress and insufficient insulin action were major factors for the development of dementia. Moreover, other co-morbidities such as hypertension and dyslipidemia may accelerate the process. Given such a clinical scenario, it is important to understand the existence of dementia and cognitive dysfunction with regard to various stages of diabetes, degree of glycemic control, and presence of micro and macrovascular complications. Further, the subset of patients who are more likely to develop cognitive decline need to be identified and treatment strategies have to be devised. Many of the studies conducted so far have been carried out in the western population. There is a paucity of studies from India, especially from the rural south Indian population, whose cultural practices are much different from the west. Hence, the present study was conducted to establish the prevalence of cognitive dysfunction in type ii diabetics in our population, and to find out the associated risk factors.

MATERIALS AND METHODS

The study was carried out after due approval from the institutional ethical committee. All patients were recruited after oral informed consent.

Inclusion Criteria

Serially encountered patients with type II diabetes above the age of 40.

Exclusion Criteria

The following patients were excluded

1. Dementia, significant hearing or visual impairment and those unable to participate in an interview in a meaningful manner
2. Past or current history of cerebrovascular accident, epilepsy or Parkinsonism.
3. Structural brain lesions or active CNS infections
4. Psychiatric diseases like major depression, schizophrenia.
5. Type I Diabetes
6. Those who refused informed consent

All the patients were subjected to a structured interview in the out-patient department which included demographic information such as age, sex, literacy level and occupation. Other details such as duration of diabetes, presence of co-morbidities such as hypertension, dyslipidemia, personal details such as smoking, alcoholism and treatment details were included. The cognition was assessed by Mini Mental Score examination (MMSE) originally devised by Folstein[13]. The MMSE is a tool that can be used at the bedside to systematically assess mental status. It is a questionnaire that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The maximum score is 30 and a score of 23 or lower is indicative of cognitive impairment. The following three cut-off levels are generally employed to classify the severity of cognitive impairment: no cognitive impairment=24-30; mild cognitive impairment=18-23; severe cognitive impairment=0-17. The collected data were thoroughly screened and entered into Excel spreadsheets and were analyzed for interpretation. Statistical Package for the Social Sciences (SPSS) version 11.0 (SPSS-Inc., Chicago, US) was used to calculate proportions. A p value of <0.05 was considered to be statistically significant.

RESULTS

78 diabetic patients attending Diabetic clinic of General Medicine department were included in the study.

Table 1: The baseline clinical characteristics are represented below in Table

Parameter		Number (Total N=78)	%
Age	40-50 years	25	32
	51 – 60	29	37.2
	>60	24	30.7
Gender	Male	42	54
	Female	36	46
Duration Of diabetes	<1 year	8	10.2
	1 -4 years	11	14.1
	5 to 9 years	23	29.5
	>10years	36	46.2
Hypertension		34	43.6
Alcohol		18	23
Smoking		15	19.2
Macrovascular complications		7	9
Microvascular complications		33	42.3
HbA1c (%)	<7	4	5
	7.1 – 8.5	11	14
	>8.5	63	81

In our study, patients were equally distributed among all the age groups. Just over half of the patients recruited were males. Majority of the patients had long standing diabetes, with duration of more than 10 years (46.2%). Nearly 50% of all patients were hypertensive. A quarter of the patients were alcohol consumers, and 20% were smokers. Macrovascular complications in the form of coronary artery disease or peripheral vascular disease were observed in 7 (9%) of the patients. 42.3% of the patients had microvascular complications, with neuropathy accounting for the majority. With regard to degree of glycemic control as reflected in the HbA1c

values, it was found that 81% of the patients had uncontrolled sugars (HbA1c >8.5%). The average HbA1c value for the study population is 10.8 with highest HbA1c is 14.2 and the lowest being 5.6. The mean MMSE in the studied population was found to be 23.3±6.4. The lowest MMSE observed was 18, and the highest score was 30. Cognitive dysfunction was noted in 43 patients (55.1%), out of which 2 patients had moderate impairment in cognition. Cognitive impairment was more common in females (54.5%) compared to males (40%). In our study, the duration of diabetes does not have a significant effect on cognition (P value0.2) But the average MMSE score for patients who had diabetes for less than 10 years was 24.4 and for more than 10 years the score was 23. Cognitive function correlates well with the level of glycemic control (P value <0.05). None of the patients who were found to have optimal glycemic control (HbA1c <7%) had any cognitive dysfunction. The mean MMSE score was 30% in all patients who had good glycemic control. There was a strong correlation between the ascending ranges of poor glycemic control and cognitive impairment. The mean MMSE score for patients who had HbA1c between 7 to 8.5% was 24.7 and for the patients who had HbA1c >8.5% was 22.7. In Diabetic patients who consumed alcohol, the cognitive impairment was very significant with P value of <0.001. The average MMSE for this patient group was 21. We found no significant difference in blood pressure, presence of micro and macrovascular complications, smoking between the normal cognitive function group and the cognitive impairment group.

DISCUSSION

Type 2 diabetes mellitus patients are at increased risk of developing cognitive impairment[1]. This study was done to evaluate the prevalence of Cognitive impairment and correlate it with glycemic control. This study was also performed to assess other risk factors. In our study, the prevalence of cognitive dysfunction among patients with type 2 diabetes was 47%. This is similar to a study published by Priyam Mukherjee *et al*[14]. In the study, cognitive impairment was observed in 42% of the study population. This study was done among Indian population. In another study published by L. Kataria *et al*. they found out 35% of the study group had MMSE score below 24[15]. They also reported that the prevalence of cognitive impairment is more in Indian population compared to west. Therefore, the prevalence of cognitive dysfunction among diabetics found in our study is consistent with previous studies. Cukierman *et al*. (2005) reported that diabetic patients were 1.5 times more likely to experience cognitive decline and frank dementia than individuals without diabetes[15]. The possible mechanisms for cognitive impairment in patients with DM are not explained fully. But it may be related to vascular endothelial disease, hyperglycemia, dyslipidemia, metabolic syndrome, hypertension, and obesity and amyloid metabolism. In this study there is a significant positive correlation (P<0.05) between HbA1C (more than 7%) and cognitive dysfunction has been noted. There is also a strong correlation between poor glycemic control and cognitive impairment. The patients who had HbA1c more than 8.5 had lower MMSE score, which is consistent with results of different studies published earlier. A study published by Medha Munshi *et al*. cognitive dysfunction in their study population was strongly associated with poor diabetes control[16]. Grodstein *et al*. reported the beneficial effect of sugar control on cognitive dysfunction[17]. In contrast to previous studies, our study did not show any significant positive correlation (p>0.05) between duration of diabetes and cognitive dysfunction. In the Framingham study (Elias *et al*., 1997), longer the duration of diabetes, the lower the score on cognitive function. But in a study done by Manschot *et al*. cognitive dysfunction is independent of duration of diabetes as in our study. In another study published by Chukwuemeka O Eze *et al*. there is no relationship between the duration of diabetes and cognitive dysfunction[18]. In our study the cognitive function was very poor in diabetic who consumed alcohol. There is a strong correlation between these two factors as reflected by the P value which was <0.0001. In a study done by Judith A. Hudetz that subjects with both diabetes and a history of alcohol abuse showed greater deficits in cognitive impairment in the form of verbal and visuospatial memory loss than those with either diabetes or a history of alcohol abuse alone. In contrast to alcohol abuse there was no significant association between hypertension and cognitive dysfunction in our study. But hypertension is an independent risk factor for cognitive dysfunction and dementia [19]. A study done by Chukwuemeka O Eze *et al*. also had similar findings that there was no relationship between hypertension and cognitive function[18] in a dibetic patients. There was no significant correlation (p>0.05) between coronary artery disease, peripheral arterial disease, diabetic neuropathy, diabetic retinopathy, and diabetic nephropathy with cognitive dysfunction in our study group. But in earlier study had showed that retinopathy is an independently associated with poor cognitive function, as revealed by Wong *et al*. 2002. Compared to previous studies, our study did not show any correlation between smoking and cognitive dysfunction. In a study published by Carla Ruis *et al* (2009) showed smoking to be a significant risk factor for some early decrements in cognition in diabetic individuals.

CONCLUSION

Cognitive dysfunction is more common in type 2 diabetes mellitus. There was a strong correlation between HbA1c value and cognitive dysfunction. There is an inverse relationship between HbA1c and cognitive function. There is also a strong correlation between alcohol consumption and cognitive dysfunction in type 2 diabetes mellitus.

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