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Expert Opinion Article

Impact Of Education On Addenbrooke's Score (ACE-III) In Type 2 Diabetes: A Cross Sectional Study In Kanpur, North India

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Abstract

Background and aim: There have been few studies from South Asia which have shown increased prevalence of cognitive impairment (CI) in diabetes and few of European and Indian studies had shown positive impact of education on Addenbrooke's Cognitive Examination-III (ACE-III) Score. The present study was designed to evaluate the impairment in cognition by using Addenbrooke's Cognitive Examination-III test and assess impact of education on ACE-III Score.

Materials and methods: We assessed cognitive function in 54 type 2 diabetes participants using Addenbrooke's Cognitive Examination-III (ACE-III) test.

Results: The mean age and HbA1c of cases was 64.5 ± 5.3 years and 8.8 ± 2.5%, respectively. The illiterate diabetic participants had more CI with compared to literate diabetic participants but there was no difference among non diabetic group.

Conclusion: Diabetes may cause CI and is related to poor self-care. Considering a high prevalence of CI in diabetes, cognitive assessment should be a part of overall evaluation. ACE-III is a sensitive and convenient tool for this purpose.

1.Introduction

One of the most challenging problems of the 21st century regarding health is diabetes mellitus. 425 million people have diabetes in the world out of which 82 million people belong to this region and by 2045.The complications of diabetes mellitus on retinal, renal, cardiovascular, and peripheral nervous systems are widely acknowledged and very few studies have established diabetes as a risk factor for dementia [2]. Cognition is a term used to describe a set of higher cerebral functions, including memory, language, executive function, attention, perception and social behaviour. The exact pathophysiology of cognitive dysfunction in diabetes is not completely understood but factors like hyperglycemia, vascular disease, hypoglycemia, and insulin resistance are postulated to play significant roles [4]. Validation of ACE-III score as tools to screen mild CI [22] including CI in type 2 diabetes. Age, gender and education of participants can have important effects on performance of ACE-III and its cognitive sub-domains [23]. In addition to this, diabetes mellitus and pre-diabetes both have been found to accelerate the rate of progression from mild cognitive impairment to frank dementia [7]. The present study was thus designed to evaluate CI among elderly (>60 years) type 2 diabetes participants using ACE-III test and impact of education on ACE-III score.

2. Materials and Methods

2.1. Study design and setting

We conducted a cross-sectional study over a period of 2 years (May 2018 to April 2020). The study was conducted in the Department of Internal Medicine, GSVM Medical College Kanpur and participants were recruited from the outpatient department. The study was approved by the Ethics Committee of the institute (EC/09/ethics/ 2018, dated 21/03/2018).

2.2. Participants

Patients of age 60 years with Type 2 diabetes of duration 2 years were considered for the study. Those who were willing to participate were evaluated for exclusion criteria. Patients who have prior stroke with impaired higher mental function, advanced heart failure and those who had significant hypoglycemia over past four weeks (a documented glucose of 54mg/dl and/or loss of consciousness secondary to hypoglycemia) were not considered for the study. Patients with known depression, epilepsy or patients on antiepileptic, psychiatric illness, acutely ill patients or patients with chronic systemic illness, substance abuse, stroke and encephalopathy were excluded from the study. A total of 180 type 2 diabetes participants were surveyed and 118 participants were excluded. Remaining 62 participants were interviewed for Beck's Depression Inventory e Hindi version (H-

BDI) [12] to exclude patients with underlying undiagnosed depression (participants with a score of 30 were excluded from the study). Finally, we had 54 type 2 diabetes participants as study participants.

2.3. Study tools

The principal investigator Dr Sorang Tashok had a formal training for assessment of cognitive function from university of Glasgow, United Kingdom (online), dated 15/05/2018. Participants were assessed for cognitive dysfunction by using validated Hindi version of Addenbrooke's Cognitive Examination test or ACE III [13]. This tool assesses 5 cognitive sub-domains: attention, memory, fluency, language and visuospatial. It has a maximum score of 100 and recommended cut-off for CI is 82 with sensitivity of 93% and specificity of 100% [14]. The ACE-III cognitive assessment tool has been used in type 2 diabetes patients with good reliability and all the questionnaires were validated in local language (Hindi).

2.4. Sample size

The prevalence of cognitive impairment in elderly population was assumed to be 25% and among diabetic population was taken to be 54% based on two previous Indian studies conducted on elderly general population and elderly type 2 diabetes patients, respectively [18,19]. The required sample in each group was 45 and assuming a drop out of 20%, we recruited 54 participants in each group.

2.5. Statistical analysis

The data obtained was transferred to Microsoft Excel (version 2016). Analysis was done using SPSS software version 22.0. The descriptive analysis was done in terms of range, frequency, percentages, mean and standard deviation. We calculated the Odds ratio (OR) for various variables using the Ordinal regression method. 95% confidence interval and p values of different variables in diabetic subjects and means of different domains of ACE-III scores in were calculated. After applying ANOVA on SPSS Version 22 P value was <.0001 in diabetic participants.

3. Results

The diabetic participants mean age was 64.5 ± 5.3years with an average duration of diabetes of 8.5±6years. Participants were using oral anti-diabetic medications (87%) and on pre-mixed insulin (18%) for glycemic control. The Educational qualification of participants were Primary level (31.5 %), high-school level (27.7%), graduates (25.9%) and 14.8% were illiterate. We found 63% of participants had CI (ACE-III score<83) and there was significant low ACE-III score in illiterate (ACE-III core 65.8) and primary level (ACE-III Score 67). Mean ACE-III score among participants was 74.9 ± 11.2. All the sub-domains of cognition were affected among participants. When individual variables were analyzed, only female gender and higher HbA1C level (>7.5%) were significantly associated with CI and education had positive impact on ACE-III Score.

Table 1: Age Wise Distribution of cases

Age group	Diabetic subjects	
	Number	Percentage (%)
60-70 years	48	88.8%
70-80 years	6	11.2%
Total	54	100%

Table 2: Gender Wise Distribution of cases

Gender group	Diabetic subjects	
	Number	Percentage (%)
Men	28	51.8%
Women	26	48.2%
Total	54	100%

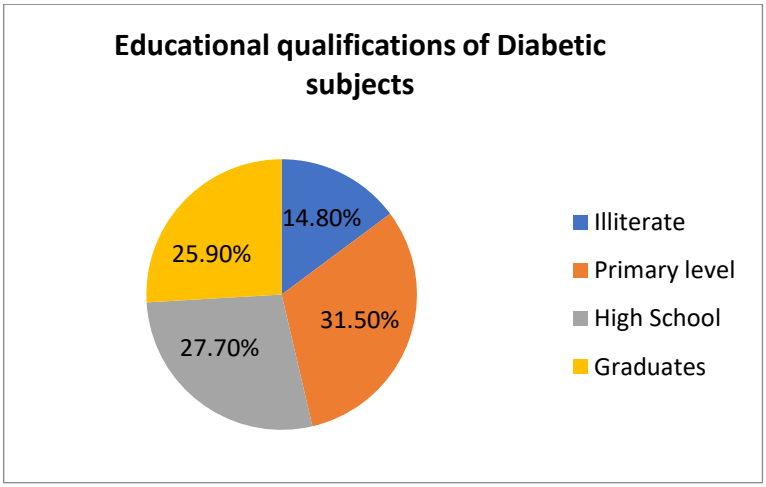

Table 3: Addenbrooke's score (ACE-III) and Educational Status of Diabetic Subjects

Educational qualification of Diabetic cases	Numbers of diabetic cases	Mean ACE-III Scores
Illiterates	8	65.88
Primary level	17	67.00
High school level	15	75.93
Graduates	14	88.86
Total	54	74.98

4. Discussion

We found a significant prevalence of CI (63%) in our study which is higher than previous studies where prevalence was 48% and 54% respectively. Considering the high prevalence of CI in type 2 diabetes and availability of free Hindi version of ACE-III , this tool can be considered for evaluation of cognition among type 2 diabetes populations. We found all the domains of ACE-III were affected with most affected being memory and fluency domains and least affected being visuospatial domain. We found that educated diabetics subjects has higher ACE-III score compared to illiterate subjects which is also shown in few studies in India [23]and abroad. This positive impact of education on ACE-III score indicating that education might help in diabetic self-care in type 2 diabetic subjects. On ordinal regression analysis, we found that higher HbA1C (>7.5%) and female gender were associated with lower ACE-III scores.

5. Conclusion

ACE-III is a freely available, validated and convenient cognition assessment tool. Uncontrolled diabetes mellitus affects cognition globally and females may be at more risk. There is positive impact of education on cogitation in type 2 diabetes patients.

Strengths of the study: ACE-III is a freely available, validated and convenient cognition assessment tool. The participants were also carefully selected after excluding other confounding factors and using H-BDI assessment beforehand to identify underlying depression.

6. Limitations

1. The sample size was small and larger similar studies are required in future to confirm the conclusions.
2. ACE-III scores have not been validated in patients with type 2 diabetes from Indian population.
3. Due to lack of data on lipid profile of controls, the adjustment for this probable confounding factor could not be done.
4. The data regarding prevalence of diabetes related complications was incomplete as a formal assessment for this was not done in all participants.

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