

## Cognitive impairment in type 2 diabetes

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### Abstract:

**Background:** Cognition declines with age is a known fact. Some studies suggest a positive correlation between the declinations of cognition with Diabetes. Studies on dementia have contributed diabetes as one of the possible causative factor for its early occurrence. During the management of diabetes, examination of cognitive functions are overlooked as a routine practice. This study attempts to examine the cognitive functions in established diabetics who are on treatment and correlate the same with duration of diabetes.

**Materials & Methodology:** This study was conducted on 100 previously diagnosed type 2 diabetic subjects including both male and female, who are on regular anti diabetic medication. They were categorised into groups based on the duration of diabetes (<1year,1-4years, 5-10years,>10years). They were given the "Mini Mental State Examination" questionnaire also referred to as Folstein test. The results were tabulated and correlated with the duration of diabetes.

**Results:** Out of 100 type 2 diabetic subjects, 25 patients had cognitive impairment. In less than 1 year category, only one person had mild cognitive impairment. In 1-5 years category,9 patients had mild cognitive impairment, while only 2 belonged to moderate category. In 5-10years category,1 patient had mild impairment, 6 had moderate impairment and 1 had severe impairment. In >10years category, out of 6 patients, 5 patients had severe cognitive impairment.

**Conclusion:** This present study has established a positive correlation between the increased duration of diabetes and cognitive impairment. Although, every diabetic patient is treated meticulously to get a good glycemic control, the cognitive function examination is always overlooked. Hence this study suggests a routine examination of the cognitive status of every diabetic subjects so that along with good glycemic control, the quality of their life can also be improved by introducing cognitive therapies at the appropriate time.

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### I. Introduction

Cognition is the process of acquiring knowledge and understanding through experience, thought and senses. In simple terms, cognition includes thinking, learning, memory and attention. It is a known fact that cognition declines with increasing age. But the fact that cognitive impairment is hastened by type2 Diabetes is unknown among common people as well as medical practitioners. Type 2 Diabetes mellitus is as such called a slow killer disease due its various complications like stroke, cardiovascular disease, neuropathy, nephropathy, retinopathy and so on[1]. Studies have proven the association between Diabetes and dementia. The pathophysiology of cognitive dysfunction in type 2 diabetes remains unclear. Some mechanisms have been considered including oxidative stress, microvascular disease causing brain infarcts and genetic factors[2]. Glycemic control, duration of diabetes and age appears to have contribution in the pathogenesis of cognitive impairment in type 2 diabetes[2]. In this study, we aim to establish the relationship between cognitive impairment and type 2 diabetes through a questionnaire-Folstein test(mini mental state examination) based analysis and add some more evidence to the existing relationship.

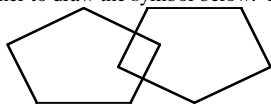
### II. Materials And Methodology

The study population consisted of 100 previously diagnosed Type 2 diabetic patients who are on treatment for glycemic control in Madha Medical College & Hospital, Chennai. The study population consisted of both men and women. Diabetic subjects age included in the study varied from 30 to 70. Duration of type 2 diabetes were recorded, and categorised into >10yrs duration, 5-10 yrs, 1-5 yrs and less than a year(recently diagnosed).

The selected patients were given the standard Mini Mental State Examination (MMSE) questionnaire, also referred as Folstein test[11]. It is a 30 point questionnaire used to measure cognitive impairment. Points are segregated and given to each category of MMSE. The categories are – orientation to time and place, registration, recall, attention and calculation, language, repetition and complex commands. Scores greater than or equal to 24 are normal. Scores lesser than 24 are categorised as either mild(19-23), moderate(10-18) or severe(lesser than or equal to 9) cognitive impairment.

Mini Mental Status Examination-Questionnaire

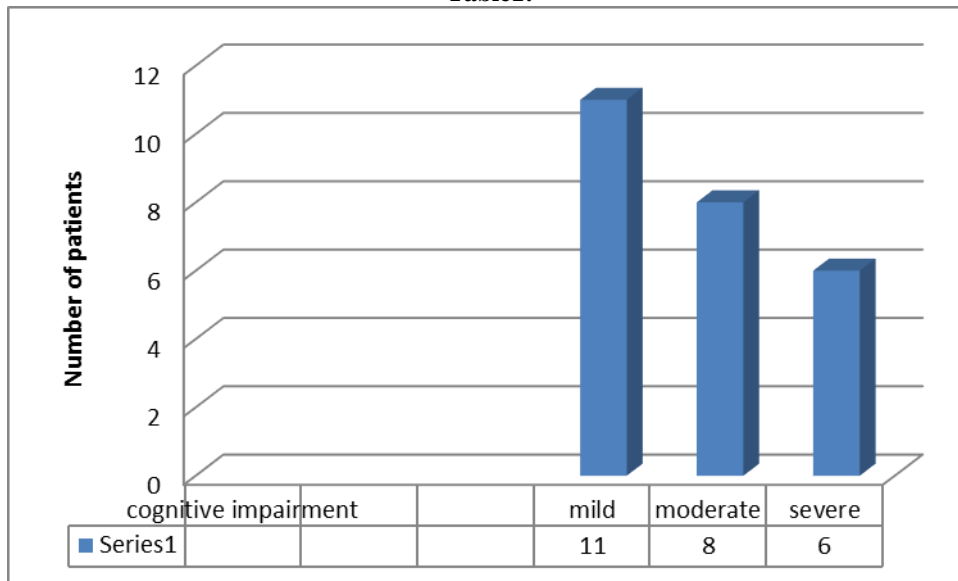
NAME: AGE: SEX: BP:  
 DM OR NOT: RBS: HT OT NOT:

Maximum Score	Patient's Score	Questions
5		“What is the year? Season? Date? Day? Month?”
5		“Where are we now? State? County? Town/city? Hospital? Floor?”
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient’s response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		“I would like you to count backward from 100 by sevens.” (93, 86, 79, 72, 65, ...) Alternative: “Spell WORLD backwards.” (D-L-R-O-W)
3		“Earlier I told you the names of three things. Can you tell me what those were?”
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		“Repeat the phrase: ‘No ifs, ands, or buts.’”
3		“Take the paper in your right hand, fold it in half, and put it on the floor.” (The examiner gives the patient a piece of blank paper.)
1		“Please read this and do what it says.” (Written instruction is “Close your eyes.”)
1		“Make up and write a sentence about anything.” (This sentence must contain a noun and a verb.)
1		“Please copy this picture.” (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.) 

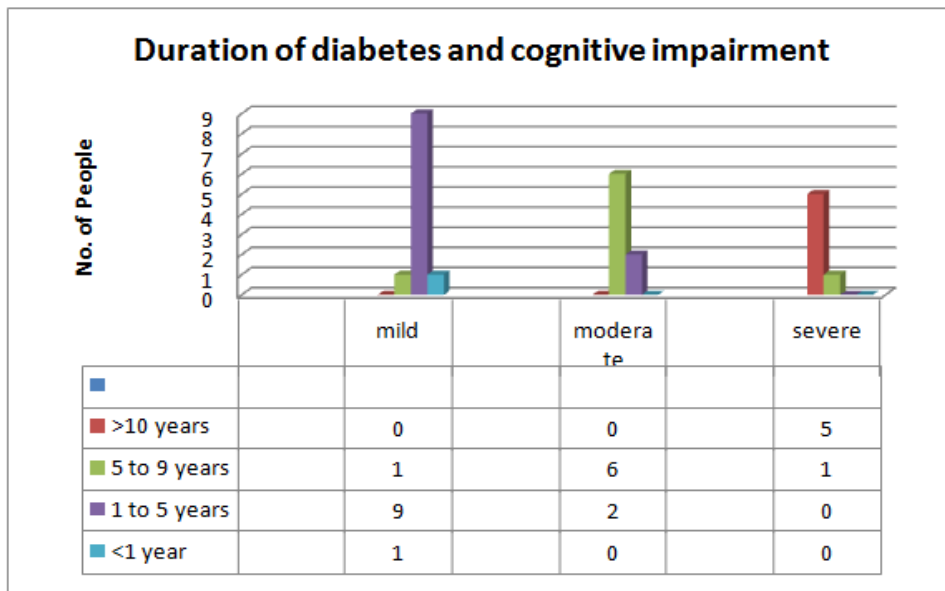
III. Results

A total of 100 diabetics patients were assessed. Out of which 25 patients had cognitive impairment. 11 patients had mild cognitive impairment, 8 had moderate and 6 had severe cognitive impairment(table 1 ). We took into account the duration of diabetes of these patients. We divided them into 4 categories - duration of diabetes more than 10 years, 5 to 10 years, 1 to 5 years and less than a year. . In less than 1 year category, only one person had mild cognitive impairment. In 1-5 years category,9 patients had mild cognitive impairment, while only 2 belonged to moderate category. In 5-10years category,1 patient had mild impairment, 6 had moderate impairment and 1 had severe impairment. In >10years category, out of 6 patients, 5 patients had severe cognitive impairment (table 2). The results are as follows

**Table1:**



**Table 2:**



**IV. Discussion**

The results of this study clearly indicates that there is definite cognitive impairment associated with diabetes. There exists a positive correlation between the severity of cognitive impairment and duration of diabetes. This may be attributed to microvascular complications of diabetes. Hyperglycaemia in type 2 diabetes is due to insulin resistance and hyperinsulinemia[3]. Insulin plays a major role in cognitive function in the brain by inducing the release of A-beta amyloid[4]. Moreover, the areas of brain involved in memory, the hippocampus and cerebral cortex have innumerable insulin receptors, indicating the importance of insulin in brain[8]. Therefore the down regulation of insulin receptors by hyperinsulinemia results in decreased insulin uptake by the brain which leads to accumulation of A-beta peptides in the brain[1]. Atherosclerosis and small vessel disease of the cerebral vessels can cause vascular dementia[5]. This creates an alzheimer's like impression in cognitive dysfunction due to diabetes. Microvascular complications of diabetes like neuropathy, nephropathy also contribute to the impairment[6]. Neural sheath damage in neuropathy and hypertensive brain damage in diabetic nephropathy is the mechanism attributed to this[7]. Every study has its own limitations. The MMSE questionnaire used in this study, per Se, has its own limitations. The questionnaire is most sensitive and highly effective in assessing cognition only among the educated population. Illiteracy and language problems arise with MMSE, especially with the rural population that we have covered in a semi urban location where the study is conducted. And this study had no control group to compare the results, which is a major drawback. Hence, a

more accurate study with exclusion of these limitations and with more population is required to further confirm our results.

## V. Conclusion

For years, physicians have been concentrating only in the treatment of diabetes based on the glycaemic control and prevention of major complications. But cognitive impairment as a complication of Diabetes has been less addressed. Early identification and assessment of cognitive impairment may improve the quality of life in a long term diabetic. Cognitive therapies may be of help in these patients.

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