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COMPARISON OF MEMORY QUOTIENT STATE BETWEEN NIDDM PATIENTS WITH GLYCEMIC CONTROL AND NONDIABETICS

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ABSTRACT

In order to test the memory state in patients with non-insulin dependent diabetes mellitus (NIDDM) after glycemic control, one-hundred patients referring to Isfahan Endocrine and Metabolism Research Center were simply randomized. They were compared in point of memory state with one hundred cases as the control group. The Wechsler Memory Scale test was utilized to evaluate the memory status of both groups. The average duration of diabetes was 6 years and the lower limit was 2 years. The mean of memory scores was 72.6 in the diabetic group and 96.4 in the control group ($p<0.05$). The mean value of fasting blood sugar in diabetic patients after glycemic control was 121 mg/dL and was 97mg/dL in the control group ($p<0.05$).

No significant difference was found between hypertensive and normotensive diabetic patients. Also,
Index (BMI) and HbA_{1c} with memory in diabetic patients. However,
significant association between serum cholesterol level and memory scale ($p<0.05$). The mean memory score in the diabetic group was lower than the control group, and the difference was statistically significant. In this study,
cemia in NIDDM patients did not prevent or ameliorate memory disturbances.
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Keywords: NIDDM, Memory, Diabetes.

INTRODUCTION

Diabetes mellitus is a disorder of metabolism and the vascular system manifested by a disturbance of the body's handling of glucose, lipid, and protein. Also, diabetes is one of the major risk factors for CVA.[1]

Diabetes is a systemic disease that can affect every organ in the body, including the CNS, and severe hypoglycemia in type 1 diabetic patients impairs motor ability, short-term memory and visuospatial tasks.[2]

Type II diabetes may be associated with impaired cognitive function.[3] A detailed search of the literature has identified 19 controlled studies in which cognitive function in type II diabetes has been examined.[3] The studies vary widely with respect to the nature of the diabetic populations studied and the psychological tests used. Thirteen studies demonstrated that diabetic individuals performed more poorly in at least one aspect of cognitive function. The most commonly affected cognitive ability was verbal memory.[4-6]

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Table I. The mean memory score in patients with NIDDM and control subjects.

Subtests of WMS*	Case Mean±SD	Control Mean±SD	*p* value**
Personal information	4.5±1.52	5.8±0.634	0.00
Orientation	3.8±1.4	4.8±0.85	0.00
Mental control	4.2±2.9	5.6±1.9	0.00
Logical memory	2.4±2.5	8.3±3.3	0.00
Repetition of numbers	3.5±2.8	6.8±2.4	0.00
Visual memory	2.8±3.3	8.2±3.3	0.00
Learning of association	7.6±4.01	12.6±8.4	0.00
Total MQ	72.6±18.6	96.4±16.4	0.00

*WMS= Wechsler Memory Scale

**Student's t-test used for equality of mean and Levene's test for equality of variances.

Table II. The relation of triglyceride and memory score in diabetic patients.

Serum TG level (mg/dL)	Mean±SD of memory score
<200	671±6.2
201-405	75.2±19.6
>450	51±3

History and duration of NIDDM and high blood pressure are significant risk factors for poor cognitive performance.[7] Lower socio-economic status may be a risk factor in the effect of diabetes on cognitive performance, perhaps by delaying diagnosis and treatment.[8] The NIDDM patients had impaired control of their learning processes. Elevated serum triglyceride levels may be related to control of mental processing in diabetic patients.[9] Poor glycemic control in older subjects with NIDDM was associated with decreased cognitive functioning. Verbal learning and memory may be improved with good glycemic control.[10,11] According to these findings, we examined the memory state in NIDDM patients after glycemic control in the middle-aged. Also, memory function was evaluated in relation to BMI, hypertension, serum triglyceride and HbA_{1c} concentrations in the subjects.

MATERIAL AND METHODS

This study is a case-control study that was done in Isfahan Endocrine and Metabolism Research Center. NIDDM diagnosis was made by utilizing glucose tolerance and HbA_{1c} test according to WHO diagnostic criteria.[12]

Objectives were 1) to determine the mean of the memory score in NIDDM subjects with glycemic control in comparison with nondiabetic subjects; 2) to evaluate the memory score in NIDDM subjects according to BMI, hyrpertension, serum triglyceride and HbA_{1c} concentrations.

The age range of subjects was between 40-60 years. One-hundred NIDDM patients with fasting blood sugar (FBS) less than 140 mg/dL were simply selected among referrals to the center. In this study, an FBS less than 140 mg/dL was considered as good glycemic control.[12] Also one-hundred subjects without recognized endocrine, neurologic or psychiatric disease, especially dementia and mental retardation, were selected as the control group. NIDDM patients were matched with controls according to age, sex and education. They were selected among the relatives and companions of patients referred to the endocrine research center. FBS in this group was less than 110 mg/dL.

FBS and serum triglyceride levels were measured and BMI and resting BP was determined in all subjects in both groups. In order to determine memory state, we utilized the Wechsler Memory Scale (WMS) as an objective scale. This scale has seven subtests including personal information, orientation for time and place, mental control, logical memory, repetition of numbers, visual memory, and associations. In this scale, Memory Quotient (MQ) was determined to take into account the age. Collected data were analysed by Student's t-test and Levene's statistical tests in SPSS and $p<0.05$ was considered significant.

RESULTS

71.3 percent of the case group and seventy-five percent of the control group were women ($p>0.05$). The age range for all subjects of the groups was 40-60 years old (mean age for case group= 51.3 and for control group= 50.9, $p>0.05$). Educational level in both groups was similar. Fifteen percent of subjects and controls were educated (diploma and higher). Lower limit of NIDDM was two years and the average of duration was 6 years. Table

I shows the mean of memory score in two groups for 7 subtests of WMS and total memory score (MQ). The mean of memory scores in the diabetic group was 72.6 (SD= 18.6) and in the control group was 96.4 (SD= 16.4) (p<0.00). So, the difference between the case and the control group is significant. There are also significant differences for all subtests of WMS.

There was no significant relationship between BMI and memory in the diabetic group (p>0.05). Also no relation was found between HbA_{1c} and memory scale in the NIDDM group. Table II shows the relation between serum triglyceride level and memory in the diabetic group. Differences between three different levels of triglyceride were statistically meaningful (p= 0.03).

Blood pressure didn't have any relationship with memory score in diabetic patients (p= 0.715). The mean of minimum BP was 8.12 and maximum BP was 12.99.

DISCUSSION

The mean memory score in diabetic subjects with good glycemic control was significantly lower than the control group, and this difference was statistically significant. Some studies have demonstrated that poor glycemic control in diabetic patients impairs cognitive function.[3,8,13] It has been shown that NIDDM patients show poor performance in learning tasks compared with control subjects.[9] In order to study if NIDDM is associated with cognitive dysfunction independently of clinically diagnosed dementia in an elderly population, in contrast to this study, Vanhanen et al. concluded that NIDDM per se is not associated with impaired memory in the elderly and NIDDM does not carry a signficant risk of cognitive dysfunction.[14] However, Zaslarsky et al. showed that visual memory score in NIDDM was lower than controls; also, there was no difference in verbal memory performance. They concluded that decreased visual cognitive function in NIDDM patients is associated with the presence and degree of autonomic neuropathy.[15] Specific neural systems within the aging brain may be differentially sensitive to the toxic effects of chronic hyperglycemia.[16] Lincoln and his colleagues stated that controlling of hyperglycemia can prevent the obvious memory dysfunction in NIDDM patients.[17] In contrast to Lincoln's study, we found a low memory score in NIDDM patients in spite of good glycemic control. The majority of the cases reported a history of long-term memory disturbance which had been affected by previous episodes of poor glycemic control, but at the time of the study, they had good glycemic control. As a result, hyperglycemia must be controlled as soon as possible to prevent or ameliorate cognitive dysfunction.

It has been proposed that brain dysfunction presented in NIDDM is correlated with kidney function.[18]

Elias et al. suggested that high blood pressure in NIDDM was a risk factor for poor cognitive performance, and hypertensive people with NIDDM were at greatest risk for poor performance on tests measuring visual organization and memory.[7,20] However, in our study, blood pressure did not correlate with memory score in NIDDM patients.

Some studies have proposed that serum total triglyceride levels correlate with memory performance and have shown that elevated triglyceride levels, especially in NIDDM patients, have negative effects on cognition.[9,19,20,21] These findings confirm the results of the present study. We found the reversed correlation between serum total triglyceride and memory score in diabetic patients. The effects of elevated triglyceride levels on cognition may be mediated by poor glycemic control, which frequently is associated with elevated serum triglyceride levels.[22] Elevated triglyceride levels, especially in NIDDM patients, and imparied glucose tolerance, reflect associated metabolic abnormalities, such as insulin resistance and accompanying hyperinsulinemia which have been associated with impaired cognitive performance.[20] However, elevated serum triglyceride levels may also affect cognitive performance by increasing blood viscosity and impairing its rheologic properties.[21] Improvement of cerebral perfusion and cognitive performance by lowering triglyceride levels has been previously observed.[9] Given the small size of the current study, our findings must be interpreted with caution.

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