ATTENTION CONTROL AND ITS CORRELATES IN DIABETIC PATIENTS

Diyabetik Hastalarda Dikkat Kontrolü ve Korelasyonları

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ABSTRACT

Objective: Attention control is crucial for diabetic patients since inappropriate usage of diabetic medications may result in imbalances of glycemic control, which in turn may irreversibly harm the brain and other organs. The patients need to be evaluated timely for deficits in their attention control to prevent this unwanted outcome. The literature lacks studies on this issue of diabetic patients. Our study aims to evaluate the attention status of diabetic patients and to reveal its relation to common psychiatric comorbidities.

Material and Methods: Sixty one diabetic patients and fifty three healthy controls were enrolled in the study. The Attention Control Scale (ATTC), and the Hospital Anxiety and Depression Scales (HADs) were applied to all participants. Also, the demographic and medical history data of the participants were collected.

Results: Attention focusing, shifting, and total attention scores were similar between diabetic patients and healthy controls. However, the depressed and anxious patients had significantly lower attention scores compared to other patients. The affected subarea of attention was focusing rather than shifting. HbA1c levels were correlated with better attention scores.

Conclusion: The attention status of diabetic individuals is affected by anxiety and depression symptoms. The ATTC scale is a good test to assess attention in diabetic patients, and if needed, treatment of anxiety in particular may help maintain attention intact and prevent medical errors and life threatening complications.

Keywords: Anxiety; Attention; Diabetes Mellitus; Depression; Hemoglobin A1c

ÖZET

Amaç: Diyabet hastalarında, diyabetik ilaçların dikkat eksikliğine bağlı uygunsuz kullanımı glisemik kontrol dengesizliklerine yol açarak beyin ve diğer organlara geri dönüşü olmayan zararlar verebileceğinden, hastalarda dikkat kontrolü çok önemlidir. Bu istenmeyen sonucu önlemek için hastaların dikkat düzeylerindeki eksiklikler açısından zamanında değerlendirilmesi gerekir. Literatürde diyabetik hastalarda bu konuda yapılmış çalışma bulunmamaktadır. Çalışmamızın amacı diyabet hastalarının dikkat durumlarını değerlendirmek ve sık görülen psikiyatrik komorbiditeler ile ilişkisini ortaya koymaktır.

Gereç ve Yöntemler: Çalışmaya 61 diyabetik hasta ve 53 sağlıklı kontrol dahil edildi. Tüm katılımcılara Dikkat Kontrol Ölçeği (ATTC) ve Hastane Anksiyete ve Depresyon Ölçeği (HAD) uygulandı. Ayrıca katılımcıların demografik ve tıbbi öykü verileri toplandı.

Bulgular: Odaklanma, odak değiştirme ve toplam dikkat puanları diyabetik hastalar ve sağlıklı kontroller arasında benzerdi. Bununla birlikte, depresif ve kaygılı hastalar, diğer hastalara göre anlamlı olarak daha düşük dikkat puanlarına sahipti. Dikkatin etkilenen alt alanı odak değiştirmeden ziyade odaklanmanın kendisiydi. Hastalık değişkeni olan HbA1c seviyeleri ile dikkat ölçeği puanları arasında pozitif korelasyon görüldü.

Sonuç: Diyabetik bireylerin dikkat durumları kaygı ve depresyon belirtilerinden etkilenmektedir. ATTC ölçeği, diyabetik hastalarda dikkati değerlendirmek için iyi bir testtir ve gerekirse özellikle kaygının tedavisi, dikkatin bozulmadan kalmasına yardımcı olabilir ve tıbbi hataları ve hayatı tehdit eden komplikasyonları önleyebilir.

Anahtar Kelimeler: Kaygı; Dikkat; Diabetes Mellitus; Depresyon; Hemoglobin A1c

INTRODUCTION

Everyday activities require changing amounts of attention. Being a part of all actions makes attention control crucial. Without a competent attentional system, it is impossible to do a task successfully. It is even more important to maintain high-quality attention while continuing a medical treatment.

Chronic diseases like diabetes mellitus always have the potential for life-threatening complications. Apart from the disease itself, misusage of medications may be a greater problem. It is known that the most common type of medical error is medication error, which is erroneous prescription, administration, or usage of a medication (1). These kind of errors may result in irreversible damage to our health. So, continuing the appropriate medication at the proper dosage is vital for all patients, especially diabetic patients. Slight misusage of insulin and other anti-diabetic preparations may result in severe hypo/hyperglycemia. This situation may cause brain damage and even death of the patient.

According to the attentional control theory, attention has two main components, which are focusing and shifting (2). Doing a task successfully requires both components to act together. There may be numerous factors interacting with the attentional system. Research on this topic revealed relations between attentional system components and psychiatric comorbidities (3,4). Diagnosing and treating these comorbidities may enhance the quality of attention and reduce the complications resulting from medication misusage.

In our study, we aimed to evaluate the attentional scores and their comparison of means in diabetic patients and healthy controls. Revealing the deficits in attentional control of diabetic patients is of great importance to emphasize the need for regular attentional assessments and prevent complications.

MATERIAL AND METHOD

Ethical approval of the study was obtained from Acibadem University and Acibadem Healthcare Institutions Medical Research Ethics Committee with the decision number 2023-06/188.

Attention Control Scale (ATTC) is a four-point Likert scale containing twenty items. It is a self-reported test measuring attention and its two major components; attention focusing and shifting. The responses vary from 1 (almost never) to 4 (always). The first nine questions are scored to calculate the attention-focusing sub-scale, while the left eleven questions are scored for attention-shifting. At the end of the test, all scores are summed to get a total score resembling the participant's attention level. One can get 20 to 80 points from the test. Some questions are reverse-scored. Higher scores mean better attentional status. Reliability and validity of the scale in Turkish population was studied in 2013.

The two major subscores and the total test score are calculated. There are no cut-off values for the total score, attention focusing, or shifting subscores. Instead, the scores are used for comparative studies.

The Hospital Anxiety And Depression Scale is a four-point Likert scale containing fourteen questions. Half of the questions are related to anxiety, and the others are linked to depression. Cases fill the test on their own, and the tester calculates the scores. The validity and reliability of the Turkish version of the test revealed cut-off points. Seven points were found to be a significant threshold for depression and ten points for anxiety (5).

The demographic data included the age, gender, medical history, hemoglobin A1c level, and medication usage of the participants.

Sixty one diabetic patients and fifty three healthy controls participated in the study after obtaining their consent. The medical history and self-reported scale results of the participants were evaluated.

In addition to the main groups (diabetic patients and healthy controls), the groups were divided by the cut-off values values to create high anxious/low anxious and high depressive/low depressive groups.

Patients with any symptoms or history of mental retardation, chronic disease (hypothyroidism, dementia etc.) other than diabetes mellitus or medication usage except antidiabetics were excluded from the study. Patients with acute infectious states and or the ones under the treatment of any infectious disease were not enrolled in the study. Also, participants with any chronic disorder, mental retardation or daily medication usage were removed from the healthy control group.

In summarizing the data, continuous variables' mean ± standard deviation, categorical variables' frequency,

and percentage values were calculated. All of the scale scores were normally distributed according to the Skewness and Kurtosis values. Independent Samples t-test for two groups and One-Way ANOVA test for three or more groups were used to compare groups in terms of scale scores. Pearson chi-square or Likelihood ratio tests were used to analyze the relationships between categorical variables, depending on the distribution of the data, and the Pearson correlation coefficient was calculated for continuous variables. Statistical analyzes were done with the SPSS program(IBM Corp. (2017), IBM SPSS Statistics Windows, Version 25.0) and the significance level was accepted as 0.05.

RESULTS

We had 36% (n=22) male and 64% (n=39) female participants in the patient group. In the healthy control group, there were 35% (n=19) male and 65% (n=34) female participants. The average age±SD of the patients was 45.18±12.51 years, and the average age of the healthy controls was 39.13±10.96 years. Comparison of the means of age resulted in statistical significance (p<0.01). The mean age of anxious and non-anxious or depressive and non-depressive patients were statistically similar (p=0.556, p=0.112 respectively). 85.7% (n=54) of the patients were using insulin preparations.

While 72.1% (n=44) of the patients had the education level of high school and above,71.6% of the controls had (n=38) of the same education level.

According to the scale scores, 36.0% (n=22) of the patients were anxious, while 62.2% (n=38) were depressed. On the other hand, the healthy controls had 43.3% (n=23) anxiety and 30.1% (n=16) depression symptoms. The summary of the HAD scale results for both groups is listed in Table 1.

Independent samples t-test was performed to compare the patient and control groups. There was

not a statistically significant difference in mean anxiety scores between the two groups (p=0.766). On the other hand, depression scores revealed a statistically significant difference between the groups (p=0.001).

The mean scores of the ATTC scale are summarized in Table 2. In comparison analysis, attention focusing (p=0.203) and shifting (p=0.376) scores were statistically similar in the patients and the control groups. Also, total attention scores were not statistically different between the patients and the healthy controls (p=0.202). These analyses indicated that being a diabetic patient did not differ attention scores from the healthy controls. However, depression scores were significantly higher in the patient group.

The patient group was divided into two subgroups according to the anxiety scores to analyze whether there was a difference in the attention scores in the patient group itself. The calculations revealed a statistically significant difference in attention-focusing scores (p=0.001) between the anxious patient group and the non-anxious patient group. Attention shifting scores were not statistically different among the groups (p=0.310). Overall attention scores were significantly different (p=0.016). These results indicated that anxiety disrupted the attention of the patients, especially attention-focusing. When the patients were divided into the depressive and non-depressive groups, only the attention-focusing scores were significantly different (p=0.001).

The correlation analysis of ATTC scores with HAD scores and patient features is summarized in Table 3. Anxiety scores were moderately correlated to the attention focusing (r=-0.583, p<0.01) and total attention (r=-0.393, p<0.01) scores, while there was no statistically significant correlation to the attention shifting scores (r=-0.169, p>0.05). Depression scores were also moderately correlated to the attention focusing (r=0.586, p<0.01) and total attention (r=-0.425, p<0.01)

Table 1. Results of the hospital anxiety and depression scale

Subscale	Group	Mean ± Std. Deviation	95% CI (Lower-Upper)	p value
Anxiety	Patient (n=61)	9.14±4.92	7.88-10.40	.768
	Control (n=53)	8.88±4.39	7.67-10.09	
Depression	Patient (n=61)	7.88±4.22	6.80-8.96	.001
	Control (n=53)	4.98±3.67	3.96-5.99	

Table 2. Results of the attention control scale (ATTC)

Subscale	Group	Mean ± Std. Deviation	Group	Mean ± Std. Deviation
Focus	Patient (n=61) Anxious (n=22) Non-anxious (n=39) Overall p value	19.31±3.78 23.25±3.82 21.83±4.23 .001	Patient (n=61) Depressive (n=38) Non-depressive (n=23) Overall p value	20.52±4.20 24.00±3.35 21.83±4.23 .001
	Control (n=53) Anxious (n=23) Non-anxious (n=30) Overall p value	19.39±6.16 25.93±4.54 23.09±6.18 .001	Control (n=53) Depressive (n=16) Non-depressive (n=37) Overall p value	21.75±6.84 23.67±5.88 23.09±6.18 .303
Shift	Patient (n=61) Anxious (n=22) Non-anxious (n=39) Overall p value	28.09±6.16 29.61±5.23 29.06±5.58 .311	Patient (n=61) Depressive (n=38) Non-depressive (n=23) Overall p value	28.94±6.23 29.26±4.43 29.06±5.58 .830
	Control (n=53) Anxious (n=23) Non-anxious (n=30) Overall p value	27.47±5.72 32.03±6.12 30.05±6.32 .007	Control (n=53) Depressive (n=16) Non-depressive (n=37) Overall p value	28.68±7.45 30.64±5.78 30.05±6.32 .304
Attention total	Patient (n=61) Anxious (n=22) Non-anxious (n=39) Overall p value	47.50±8.43 52.61±7.37 50.77±8.09 .016	Patient (n=61) Depressive (n=38) Non-depressive (n=23) Overall p value	49.52±8.52 52.82±7.01 50.77±8.09 .123
	Control (n=53) Anxious (n=23) Non-anxious (n=30) Overall p value	46.86±10.61 57.96±9.99 53.15±11.58 .001	Control (n=53) Depressive (n=16) Non-depressive (n=37) Overall p value	50.43±13.44 54.32±13.44 53.15±11.58 .337

Table 3. Summary of the correlation analysis of HAD subscores and HbA1c values to ATTC subscores in the patient group

HAD sub-scores and patient features	Focus Correlation coeff. p value	Shift Correlation coeff. p value	Attention total Correlation coeff. p value
Anxiety	-0.583	-0.169	-0.393
	.001	.192	.002
Depression	-0.586	-0.233	-0.425
	.005	.071	.001
HbA1c	0.135	0.298	0.265
	.298	.020	.039

HAD: Hospital anxiety and depression scale, ATTC: Attention control scale, bold values indicate statistically significant p values, coeff: Coefficient, HbA1c: HemoglobinA1c

scores, while there was no statistically significant correlation to the attention shifting scores (r=-0.233, p>0.05). These findings indicated that these psychiatric comorbidities negatively affected the attention status of the patients, especially their focusing.

Interestingly, HbA1c levels were significantly correlated to the attention shifting (r=0.298, p<0.05) and total attention (r=0.265, p<0.05) scores in a positive way. However, low R values indicated that these correlations were weak.

DISCUSSION

Attention control may be defined as the ability of a person to focus and shift their attention to tasks. This ability is crucial for diabetic patients since any attentional deficiency leading to medication misuse may result in irreversible damage to the brain and other organs. However, the literature lacks research on the attentional status of diabetic patients and their psychiatric correlations.

Attention control theory has some assumptions to comprehend. Performance efficiency stands for the amount of attentional system sources used for a specific task. On the other hand, performance effectiveness represents the success of doing a task. Worrisome thoughts, anxiety, and threat-related stimuli are expected to allocate attentional resources toward responding to the threat-related stimulus rather than goal-directed plans, resulting in efficiency loss. Therefore, anxiety is expected to impair performance efficiency rather than effectiveness (2). If the attentional resources are not enough, performance effectiveness may be hindered likewise. An interesting study on footballers proved this with significant reduction in shooting accuracy under threatening stimuli (6). Apart from subtle interactions between diabetes mellitus and attention, there is clear evidence for the disturbing effects of psychiatric comorbidities on the attentional system. With the help of functional neuroimaging modalities attentional control system domains in the brain and their relation to anxiety were studied (7). A high level of anxiety was found to be associated with compromised performance efficiency (8). If attentional resources are adequate, performance effectiveness may not be reduced in anxious individuals (9). Our results comply with these suggestions. With increasing anxiety scores, the diabetic patients in our sample had lower attention scores, especially lower focusing scores.

Increased HbA1c levels were found to be associated with decreased cognition in shorter disease durations, while increased HbA1c levels were found to be associated with increased cognition (10). Our study revealed a similar positive correlation between HbA1c level and attention, which is a fundamental part of cognition. This finding may be due to the long duration of the disease in our patient group. Another study on the patients with diabetes mellitus showed that transient hyperglycemia altered attention and gait (11). An Indian study also found connections between high blood glucose level and impaired concentration and memory in the patients with diabetes mellitus (12).

Concentration (focusing) problems and attention deficits are criteria for a major depressive disorder diagnosis. So, attention deficits should be monitored and treated to achieve a better quality of life (13). In compliance with the literature, our results for the patients showed a negative correlation between the focusing/total attention scores and the depressive symptoms.

CONCLUSION

The attention status of diabetic individuals is affected by anxiety and depression symptoms. The ATTC scale is a good test to assess attention in diabetic patients, and if needed, treatment of anxiety in particular may help maintain attention intact and prevent medical errors and life threatening complications.

The cognitive status of the participants was evaluated according to the medical history, medication usage and prior diagnoses. No cognitive testing was done. However, none of the participants showed any sign of a cognitive disorder during the history taking or scale scoring. Also, the comparison of the mean age of the patient and the control group was statistically different. However, attention scores did not differ between the patient and control groups.

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