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Emotional and Behavioral Problems and Glycemic Control in Adolescents with Type 1 and Type 2 Diabetes

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Abstract

Objective: This study investigated the emotional and behavioral problems of adolescents with diabetes. We also compared the emotional and behavioral problems according to the type of diabetes and glycemic control.

Methods: Sixty-five adolescents with diabetes (type 1 diabetes; n=51, type 2 diabetes; n=14) and 83 healthy controls participated in this study. Glycemic control was assessed based on the mean HbA1c level, and the patient participants were divided into the following HbA1c groups: good (HbA1c<7.5%, n=17) and poor (HbA1c ≥ 7.5%, n=48). Emotional and behavioral problems were evaluated using the Korean version of the Youth Self-Report (YSR).

Results: The YSR scores of the adolescents with diabetes were significantly higher than those of the healthy controls in terms of total problems, internalizing problems, externalizing problems, thought problems, rule-breaking behavior, aggressive behavior, and lower in terms of academic performance. The adolescents with type 2 diabetes had significantly more problems than those with type 1 diabetes; specifically, the adolescents with type 2 diabetes had more total problems, internalizing problems, anxious/depressed, social problems. No significant differences were found in the YSR scores between the good and poor HbA1c group.

Conclusion: This study revealed that the adolescents with diabetes had more emotional and behavioral problems than did the healthy adolescents. The relationships among type of diabetes, glycemic control, and psychological problems might require further investigation.

Keywords: Adolescent; Diabetes; Emotion; Behavior

Introduction

The incidence of diabetes among adolescents is on the rise globally. The global diabetes prevalence of adolescents was estimated that would rise from 171 million in 2000 to 366 million in 2030 [1]. The prevalence of type 2 diabetes has also increased among adolescents and accounts for 20% of diabetes among adolescents aged between 10 and 19 years [2,3].

Adolescents with diabetes require strict self-management in all aspects of their lives and are strongly advised to follow treatment guidelines that cover insulin self-administration, glucose tests, regular exercise, and dietary regimens. Without proper glycemic control, diabetic adolescents will experience hypoglycemic shock, ensuing emotional anxiety, and psychological withdrawal due to concerns about related chronic diabetic complications. Additionally, the treatment of such symptoms requires frequent hospitalization, which makes it difficult for such patients to stay committed to everyday school requirements and exerts potentially negative effects on friendships and adaptations to their school life [4]. Adolescent patients with diabetes are particularly vulnerable to psychological problems because they are at a developmental stage in which people typically experience physical, psychological, and social changes while they are experiencing isolation from their peers and facing the grave prospect of life-long treatment [5]. One longitudinal study reported that 47.6% of youth with diabetes developed psychiatric morbidity during the first 10 years of diabetes [6].

Although some previous studies of the psychological aspects of diabetic adolescents have shown that patients exhibit depression, anxiety, and aggressive behaviors [7-9] other studies have reported that the associations between diabetes and emotional/behavioral issues among adolescent patients are weak [10-12]. Thus, there is no consensus regarding the emotional and behavioral outcomes of diabetic adolescents.

Type 1 conditions require insulin treatment and, compared to type 2 diabetes patients, type I patients are more likely to exhibit polydipsia and polyuria. On the other hand, type 2 diabetes is closely related with lifestyle factors such as overeating, physical inactivity, and obesity [13]. Thus, it is probable that differences in the emotions and behaviors of type 1 and type 2 diabetic adolescents exist. However, currently, few studies have reported on these potential disparities.

Because diabetes treatments require stringent self-management, any psychological problems that adolescent patients might develop can potentially affect their compliance with treatment [14]. Low patient compliance potentially implies improper glucose control that can exacerbate the condition, which in turn can instigate emotional and behavioral problems in adolescents with diabetes. Therefore, it is important to determine whether any of the emotional or behavioral issues of diabetic adolescents affect the self-management of their glucose levels.

Although the number of younger diabetic patients is increasing, the number of studies that have examined the emotional and behavioral aspects of adolescent diabetes is far from sufficient. Emotional and behavioral problems of diabetic adolescents may persist into adulthood

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and predict later psychiatric symptoms, thus early assessment and intervention is important [15]. Therefore, further studies are necessary to give the consensus associated with emotional and behavioral problems of diabetic adolescents.

In this context, the present study formulated three hypotheses: 1) diabetic adolescents would exhibit more behavioral and emotional problems compared to the healthy adolescents, 2) there would be differences between type 1 and type 2 diabetic adolescents on the psychological profile, and 3) the associations of emotional and behavioral problems with glycemic control would exist in diabetic adolescents.

The objectives of the present study were as follows: 1) to examine and compare the emotional and behavioral problems of adolescents with diabetes and those of a healthy control group, 2) to investigate the differences between the emotional and behavioral problems of adolescents with type 1 and type 2 diabetes, and 3) to examine the differences of emotional and behavioral problems between good and poor glycemic control groups.

Methods

Participants

This is case control study comparing cases with diabetes to controls without diabetes matched on sex, and age. A total of 148 patients (n=65 in the patient group and n=83 in the control group) participated in the current study. The diabetes cases were recruited from a pool of diabetic outpatients at the Pediatric Department of Dong-A University Hospital, Busan, Korea. The healthy controls were recruited from a group of adolescents who visited the hospital for regular check-ups and were free of any no chronic physical or psychological condition.

Diabetes cases were met the following inclusion criteria: (1) a medical diagnosis of diabetes by a physician based on the American Diabetes Association (ADA) and World Health Organization (WHO) criteria for diabetes mellitus in young adult people [16] (2) receiving treatment for at least one year; (3) between the ages of 13 and 18 years. Adolescents were excluded based on the following criteria: (1) having any previous or present psychiatric and/or neurological disorders such as mental retardation, epilepsy, schizophrenia; (2) having other chronic medical conditions such as metabolic or chromosomal disorders; and (3) previous history of any kind of head injury. Non-diabetes controls were satisfied the same criteria for enrollment barring the diabetes status.

Initially, 153 adolescents were recruited in our study. Three individuals were excluded since they did not complete study questionnaire, two individuals were excluded since they did not meet the criteria. Thus, a total of 148 patients (n=65 in the patient group and n=83 in the control group) participated in the current study. Informed consent to participate in this study was provided by participants and parents. The Institutional Review Board of the Dong-A University Hospital, gave ethical approval of the research procedure.

Variables related to diabetes

Regarding the diagnoses of type 1 and type 2 diabetic conditions, we followed the ADA and WHO criteria for the classification of diabetes mellitus in young adult people [16]. We defined the duration of diabetes as the period from the onset of the condition to the starting date of participation in the current study.

Glycated hemoglobin (HbA1c) indicates the combined form of hemoglobin and glucose are combined in red blood cells. HbA1c is indicative of a patient's glycemic control over the previous past 2 to 3 months. While the normal range of HbA1c values is between 4 and 6%, the ADA have set targeted glycemic levels at or below 7.5% for diabetic adolescents aged 13 to 19 years [17]. The current study used the mean of the of HbA1c estimates acquired within the previous 1 year. We divided the adolescent diabetic patients into a group with good glycemic control (HbA1c<7.5%) and a group with poor glycemic control (HbA1c ≥ 7.5%) and analyzed emotional and behavioral issues according to group membership.

The Youth Self-Report (YSR)

The YSR is a scale used to assess the self-reported emotional/behavioral problems and social competences of adolescents aged 11 years or older [18]. The K-YSR contains behavioral and social items. The YSR behavioral problem scale consists of the following eight different subcategories: anxious/depressed, withdrawn/depressed, somatic complaints, rule-breaking behavior, aggressive behavior, social problems, thought problems, and attention problems. The internalizing problems encompass anxious/depressed, withdrawn/depressed, and somatic complaints, and the externalizing problems include rule-breaking and aggressive behavior. The social scale was designed to gauge interpersonal relations and overall academic matters and is composed of social competence and academic performance categories. Higher scores on the problem scales are thought to indicate greater problems in emotional and behavioral aspects, and lower scores on the competence scales are thought to indicate greater the problems in sociability and academic performance. The internal consistency scores of the Korean version of the YSR as determined with Cronbach's alphas are between 0.63 and 0.85 [19].

Statistical analyses

The data were checked for its normality of distribution using Kolmogorov-Smirnov test. Because our data did not show a normal distribution, we use Chi-square test and Mann-Whitney *U* test to compare non-parametric values. To test our hypothesis, we treated YSR scores as dependent variables and presence of diabetes, type of diabetes, and HbA1c as independent variables in Mann-Whitney *U* test. All data in the current study were analyzed with SPSS version 18.0 (SPSS Inc. Chicago, IL, USA) for Windows. We adopted a statistical significance level of 0.05.

Results

Demographic and clinical characteristics

There were no significant differences in age or gender between the patient group and control group. The patient group contained 51 type 1 diabetic adolescents (78.5%) and 14 type 2 diabetic adolescents (21.5%). Seventeen of these patients (26.2%) had an HbA1c level below 7.5%, and 48 had an HbA1c level over 7.5% (73.8%). The mean HbA1c estimate in the patient group was 8.5% (± 1.5), and the average duration of diabetes was 6.2 years (1-10 years) (Table 1).

Comparisons of the YSR scores between the diabetes and control groups

Relative to the control group, the diabetic adolescents exhibited higher scores in total problems (48.1 ± 12.4 vs. 40.5 ± 13.3), internalizing problems (48.1 ± 10.9 vs. 43 ± 12.6), externalizing problems (48.2 ± 14.2 vs. 40.7 ± 11.3), rule-breaking behavior (53.8 ± 7.2 vs. 51.5 ± 3.7), aggressive behavior (54.1 ± 8.1 vs. 51.5 ± 3.5), and thought problems

(53.8 ± 7.2 vs. 52.6 ± 5.2) ($p<0.05$). In terms of academic performance, the patient group scored lower than did the healthy controls ($p<0.05$) (Table 2).

Comparisons of the YSR scores between the type 1 and type 2 diabetes groups

The type 2 diabetes patients scored higher for total problems (53.4 ± 8.4 vs. 46.6 ± 13.0), internalizing problems (54.6 ± 11.0 vs. 46.3 ± 10.2), anxious/depressed (55.8 ± 5.0 vs. 51.9 ± 3.7), and social problems (54.6 ± 5.3 vs. 52.2 ± 4.6) compared to their type 1 counterparts ($p<0.05$) (Table 3).

Comparisons of the YSR scores of the good and poor glycemic groups

Based on HbA1c levels, we divided the patients in a good glycemic subgroup (HbA1c under 7.5%) and a poor glycemic subgroup (HbA1c over 7.5%) to conduct an analysis of the YSR scores. There were no significant differences in the YSR scores between the two-glycemic subgroups (Table 4).

Discussion

The present study was undertaken to explore whether the prevalences of emotional and behavioral problems were higher among adolescent diabetic patients than among their healthy peers. In consistent with the first hypothesis we observed more emotional and behavioral problems among the patients. These results are in agreement with those of previous studies, which reported psychological distress are more prevalent among young diabetic patients than among healthy young adults [20,21]. It is possible that adolescents with diabetes are more likely to experience psychological problems because they are exposed to complicated and continuous treatment procedures, medication regimens, frequent tests and injections. They also experience the emotional burden and pressure from family and medical staff [22]. Such patients are likely to develop aggressive or rule-breaking behaviors to externalize their emotional problems. The biological characteristics of diabetes might also exacerbate such conditions by influencing their emotional and behavioral structures [23].

In consistent with the second hypothesis, significant differences in the emotions and behaviors of type 1 and type 2 diabetic adolescents exist. We observed more emotional and behavioral problems in the

	Adolescents with diabetes (n=65)	Control (n=83)	p
Sex[a]			
Male	27 (41.5%)	41 (49.4%)	0.34*
Female	38 (58.5%)	42 (50.6%)	
Type of diabetes[a]			
Type 1 diabetes	51 (78.5%)	-	
Type 2 diabetes	14 (21.5%)	-	
HbA1c[a]			
<7.5%	17 (26.2%)	-	
≥ 7.5%	48 (73.8%)	-	
Age[b], years	14.04 (±0.5)	14.46 (±1.2)	0.38**
HbA1c[b]	8.5 (±1.5)	-	
Duration of diabetes[b], years	6.2 (±2.8)	-	

[a]n (%), [b]mean (SD), *Chi-Square test **Mann-Whitney *U* test

Table 1: The participants' demographic characteristics

	Adolescents with diabetes (n=65)	Controls (n=83)	p*	Cohen's d
	Mean (SD)	Mean (SD)		
Total problems	48.1 (±12.4)	40.5 (±13.3)	<0.05	0.60
Internalizing problems	48.1 (±10.9)	43 (±12.6)	<0.05	0.43
Anxious/depressed	52.7 (±4.3)	52.1 (±4.4)	0.13	0.14
Withdrawn/depressed	54.3 (±6.3)	53.1 (±5.5)	0.30	0.20
Somatic complaints	52.7 (±4.8)	52.9 (±5.4)	0.08	-0.04
Externalizing problems	48.2 (±14.2)	40.7 (±11.3)	<0.05	0.58
Rule-breaking behavior	53.8 (±7.2)	51.5 (±3.7)	<0.05	0.40
Aggressive behavior	54.1 (±8.1)	51.5 (±3.5)	<0.05	0.42
Social problems	53.4 (±6.1)	52.1 (±4.3)	0.24	0.25
Thought problems	53.8 (±7.2)	52.6 (±5.2)	<0.05	0.19
Attention problems	53.0 (±7.8)	51.4 (±3.0)	0.43	0.27
Total competence	44.6 (±21.1)	49.2 (±22.7)	0.06	-0.21
Social competence	50.5 (±14.4)	48.3 (±20.9)	0.53	0.12
Academic Performance	48.4 (±10.1)	53.0 (±13.3)	<0.05	-0.39

* Mann-Whitney *U* test

Table 2: Youth Self-Report scores of the adolescents with diabetes and the healthy controls

	Type 1 diabetes (n=51)	Type 2 diabetes (n=14)	p*	Cohen's d
	Mean (SD)	Mean (SD)		
Total problems	46.6 (±13.0)	53.4 (±8.4)	<0.05	-0.62
Internalizing problems	46.3 (±10.2)	54.6 (±11.0)	<0.05	-0.78
Anxious/depressed	51.9 (±3.7)	55.8 (±5.0)	<0.05	-0.87
Withdrawn/depressed	52.7 (±5.1)	58.4 (±12.4)	0.07	-0.60
Somatic complaints	53.7 (±6.2)	56.3 (±6.8)	0.12	-0.40
Externalizing problems	47.4 (±14.2)	51.3 (±14.4)	0.37	-0.27
Rule-breaking behavior	53.4 (±6.5)	55.3 (±9.4)	0.47	-0.24
Aggressive behavior	54.1 (±8.3)	53.9 (±7.6)	0.49	0.03
Social problems	52.2 (±4.6)	54.6 (±5.3)	<0.05	-0.48
Thought problems	53.3 (±6.5)	53.6 (±4.8)	0.58	-0.05
Attention problems	53.1 (±8.1)	52.9 (±6.4)	0.59	0.03
Total competence	47.3 (±17.9)	34.6 (±28.5)	0.24	0.53
Social competence	51.3 (±14.4)	47.6 (±14.9)	0.23	0.25
Academic Performance	49.1 (±9.3)	46.0 (±12.5)	0.32	0.28

* Mann-Whitney *U* test

Table 3: Youth Self-Report scores of the adolescents with type 1 and type 2 diabetes

	Good HbA1c (<7.5%) (n=17)	Poor HbA1c (≥7.5%) (n=48)	p*	Cohen's d
	Mean (SD)	Mean (SD)		
Total problems	49.4 (± 9.4)	47.6 (± 13.4)	0.46	0.16
Internalizing problems	49.1 (± 10.1)	47.8 (± 11.2)	0.48	0.12
Anxious/depressed	53.0 (± 4.3)	52.6 (± 4.3)	0.43	0.09
Withdrawn/depressed	55.5 (± 7.8)	53.4 (± 7.5)	0.09	0.27
Somatic complaints	52.1 (± 3.8)	55.0 (± 6.9)	0.12	-0.52
Externalizing problems	48.1 (± 15.8)	48.3 (± 13.8)	0.97	-0.01
Rule-breaking behavior	54.0 (± 8.5)	53.7 (± 6.8)	0.96	0.04
Aggressive behavior	54.0 (± 7.7)	54.1 (± 8.3)	0.93	-0.01
Social problems	53.5 (± 5.3)	52.4 (± 4.7)	0.33	0.22
Thought problems	52.4 (± 3.7)	53.7 (± 6.8)	0.64	-0.24
Attention problems	54.5 (± 11.9)	52.5 (± 5.7)	0.64	0.21
Total competence	44.8 (± 23.6)	44.5 (± 20.3)	0.56	0.01
Social competence	52.0 (± 7.7)	50.0 (± 16.2)	0.41	0.16
Academic Performance	51.5 (± 11.4)	47.3 (± 9.5)	0.14	0.40

*Mann-Whitney *U* test

Table 4: Youth Self-Report scores for adolescents with good HbA1Cs and poor HbA1Cs

adolescents with type 2 diabetes than in those with type 1 diabetes. One possibility to explain this finding might be due to the higher level of obesity that is generally found among type 2 patients relative to type 1 patients. Obesity could negatively affect the emotional, behavioral, and adaptive capacities of the young patients [24]. Adolescents with severe psychological problems might obtain higher incidence of type 2 diabetes, because of their improper lifestyle, which is important risk factor of type 2 diabetes. Therefore, premorbid emotional and behavioral problems of adolescents with type 2 diabetes would have influence on this finding. Previous studies of the emotional and behavioral problems of young patients with diabetes have tended either to examine only type 1 patients or not to differentiate between Types 1 and 2. In this regard, the present study provides some evidence that is suggestive of emotional and behavioral differences between adolescents with types 1 and 2 diabetes. However, further research is needed to explore other relevant variables that might explain how such disparities arise.

In contrast to third hypothesis, we found no significant differences between the good glycemic control group (HbA1c under 7.5%) and the poor glycemic control group (HbA1c over 7.5%) in terms of emotional/behavioral problems. The results of other related studies have failed to create a consensus regarding the associations between the emotions and behaviors of young diabetic patients and their glycemic control [9,25]. Cho et al. reported that their patients exhibited greater emotional and behavioral problems when they had a poor glycemic state [20]. In contrast, Bryden et al. examined diabetic adolescents with emotional problems, such as depression and anxiety, and found the glycemic states of these patients were good and equivalent to those of healthy controls [26]. Other reports have suggested that young patients with anxiety pay more attention to their glycemic control and respond better to any glucose-related symptoms and are thus better able to manage their glycemic levels [27,28]. Because the present study examined HbA1c as the sole indicator of diabetic management, further research should explore other biological indices to evaluate glycemic control and examine additional treatment information, such as dosage, regimen, and frequency of hospitalization, which might provide indirect indications of symptoms, complications, and hypoglycemia risks.

Another finding of the present study is that the diabetic adolescents were worse at managing academic performance than were the healthy controls. This finding could potentially be due to the influence of the emotional and behavioral problems experienced by the patient group on their academic performance. It is also possible that the treatment requirements and hospitalizations were disruptive to their schooling and that the particular neurological condition caused by hypoglycemia inhibited the proper functioning of the cognitive capabilities of these patients [29]. In the current study, we used only fragmentary information and self-report tools to assess academic performance. Therefore, future research should use methods that are better suited to the evaluation of academic and cognitive functions.

The present study has some limitations. First, the patient participants' morbidity durations exhibited a large standard deviation. Variations in emotional and behavioral problems that depended on the duration of diabetes could potentially have been present. Second, the current study did not consider the social and circumstantial factors that might have influenced the emotional and behavioral problems, such as the parents' economic and educational statuses and parenting style, family structure and level of support, and peer relationships. Third, we were only able to secure a small sample size in the type 2 diabetic patient group, which might have resulted in relatively weak statistical power.

Despite these limitations, the present study provided evidence that adolescents with diabetes are more likely to experience emotional and behavioral problems than are their healthy peers. We suggest that assessments and considerations of the emotional and behavioral issues of young patients with diabetes should be included with the regular treatments for their symptoms and disorders. Pediatrician should assess the emotional and behavioral problems of diabetic adolescents with screening test, and psychiatrists should concern with the associations of psychological problems with aspects of diabetes. Cooperation between pediatrician and psychiatrist might be needed. In future studies, the specific elements that affect the emotions and behaviors of such patients, including glycemic control, type of diabetes, and social/environmental influences, should be further elucidated. Progressive research exploring the correlations between adolescent diabetes and psychological conditions is also needed. Modification of treatments and follow-ups will foster understanding of how the emotional and behavioral problems of young patients with diabetes can be improved.

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