Impact of Anxiety, Depression and Eating Disorders on Glycemic Control of Adolescents with Type 1 Diabetes Mellitus

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Abstract: Background and objectives: Type 1 diabetes mellitus is one of the most common chronic unremitting medical conditions that develop in childhood or adolescence. There is a bimodal age of onset, with the first peak at 4 to 6 years and second peak in early adolescence. Adolescents with diabetes are at increased risk of developing psychiatric (10-20 %) or eating disorders (8-30%), leading to non-compliance with treatment and deterioration of diabetic control, That's why it was important to carry out this study to detect these psychiatric disorders among Egyptian adolescents with type 1 diabetes and to detect how they can affect the glycemic control. **Method:** This is a cross sectional study, which include (100) adolescents with type 1 diabetes mellitus. They were selected from Pediatric Diabetes Center in Alfardos Health Insurance Clinic at Mansoura. Glycosylated Hb of studied patients were collected from their medical records. All patients were psychologically evaluated by Hamilton scale for depression, Hamilton scale for anxiety and Diabetes eating problem survey-revised (DEPS-R) for eating disorders to detect anxiety depression and eating disorders in our patients and their relations with glycemic control. **Results:** We found in this study that Depression, anxiety and eating disorder were higher among patients with type-1 diabetes; and all were associated with poor diabetic control. **Conclusion:** All patients with type1 diabetes should be screened for psychiatric disorders, particularly, anxiety, depression and eating disorders as they are associated with poor glycemic control.

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1. Introduction

Type 1 diabetes mellitus is a lifelong metabolic disorder that is treated with a complex regimen of insulin injections, diet and exercise, and can greatly affect the lives of adolescent patient and his family.[1]

Adolescence is a period of major physiological and psychological changes that begins with the onset of physiologically normal puberty, and ends when an adult identity and behavior are accepted. This period of development corresponds roughly to the period between the ages of 10 and 19 years, which is consistent with the World Health Organization's definition of adolescence.[2]

Adolescence with diabetes are at increased risk of developing psychiatric (10-20 %) or eating disorders (8-30%), leading to non-compliance with treatment and deterioration of diabetic control.[1]

2. Patients and Method

This is a cross sectional study, which include (100) adolescents with type 1 diabetes mellitus. They were selected from Pediatric Diabetes Center in Alfardos Health Insurance Clinic at Mansoura during the period from June to December 2016.

Inclusion criteria:

1- Both sexes.

2- Age range between 12-18 years.

3- Both parents alive and living together.

4- No family history or past history of psychiatric illness.

5- Verbal consent to participate in this study.

Exclusion criteria:

1-Patients with other chronic diseases as: chronic renal failure and rheumatic heart disease.

2-Patients with chromosomal abnormalities as: klienefelter syndrome and turner syndrome.

3-Patients with apparent congenital anomalies.

Method of the work:

1- Clinical evaluation of the patients.

- Demographic characteristics (age, sex and residence) were documented.
- Full history taking: including present and past history of diabetes, as the time of onset, duration of disease, and clinical manifestations and school performance.
- Detailed clinical examination was done for each patient to ensure fulfilling of inclusion criteria and exclude those with any of exclusion criteria.
- Patients were on the same insulin regimen used for treatment (Basal-bolus regimen / multiple daily injection therapy), they were classified according

to diabetes control (based on HA1c) into two groups: patients with controlled diabetes (HA1c ≤ 8) and patients with uncontrolled diabetes (HA1c > 8).

2- Psychometric evaluation including:

- Hamilton scale for depression.
- Hamilton scale for anxiety.
- Diabetes eating problem survey-revised (DEPS-R) for eating disorders.

3-The glycosylated hemoglobin measure of the last month was collected from the medical records of the selected patients.

Statistical analysis of data: the collected data were coded, tabulated and statistically analyzed using statistical package for social science version 22 (IBM®, SPSS®, USA).

Quantitative data were presented as mean and standard deviation, while qualitative data were presented as number and percentage. When numerical data were abnormally distributed, the median value was also calculated. Independent samples student (t) test, Mann Witney test, and Chi square test were used for comparison between two groups of normal distributed, abnormally distributed and categorical variables respectively. When comparison was between more than two means, the one-way analysis of variance was calculated. P value <0.05 was considered significant.

3. Results

Table (1): distribution of studied patients as regard to diabetes control

	No.	%
Controlled	40	40.0
Uncontrolled	60	60.0
Total	100	100.0

Table (2): comparison between studied groups as regard to patient characteristics

		Controlled	Uncontrolled	Test	P value
Sex	Male	27 (67.5%)	31(51.7%)	2.47#	0.14
	Female	13(32.5%)	29(48.3%)		
Age / Years		13.52±1.85	14.53±1.86	2.65$	0.009*
Age at diagnosis		10.50±2.21	10.93±2.94	0.79$	0.43(ns)
Weight / Kg		47.30±11.87	54.15±13.43	2.61$	0.010*
Height / Cm		149.75±11.98	154.66±9.90	2.23$	0.028*
Residence	Urban	28(70.0%)	31(51.7%)	3.36#	0.049*
	Rural	12(30.0%)	29(48.3%)		
Consanguinity	Yes	7(17.5%)	6(10.0%)	1.19#	0.27(ns)
	No	33(82.5%)	54(90.0%)		
Family history Of DM	Positive	20(50.0%)	32(53.3%)	0.11#	0.74(ns)
	Negative	20(50.0%)	28(46.7%)		

Table (3): comparison between studied groups as regard to parent education

		Controlled		Uncontrolled		Statistics	
		No.	%	No.	%	X^2	P value
Father education	Illiterate	0	0.0%	6	10.0%	34.26#	0.001*
	Read and write	0	0.0%	11	18.3%		
	Nine years education	6	15.0%	21	35.0%		
	Twelve years education	10	25.0%	15	25.0%		
	Fourteen years	14	35.0%	6	10.0%		
	Sixteen years or more	10	25.0%	1	1.7%		
Mother education	Illiterate	0	0.0%	9	15.0%	46.54#	0.001*
	Read and write	0	0.0%	13	21.7%		
	Nine years education	10	25.0%	20	33.3%		
	Twelve years education	6	15.0%	16	26.7%		
	Fourteen years	18	45.0%	2	3.3%		
	Sixteen years or more	6	15.0%	0	0.0%		

Table (4): comparison between studied groups as regard to Hamilton depression score

	Median	Mean	S. D	Minimum	Maximum	t	P
Controlled	5.00	4.87	2.33	0.00	10.00	5.70	0.001*
Uncontrolled	9.00	9.38	4.61	0.00	19.00		
Total	6.50	7.55	4.43	0.00	19.00		

Table (5): comparison between studied groups as regard to prevalence of depression

		Controlled		Not controlled		Statistics	
		No.	%	No.	%	X^2	P
Depression	Absent (0-9)	38	95.0%	33	55.0%	19.05	0.001*
	Mild (10-13)	2	5.0%	15	25.0%		
	Moderate (14-20)	0	0.0%	12	20.0%		

Table (6): comparison between studied groups as regard Hamilton Anxiety Rating Scale

Variable	Group	Absent	Mild	Moderate	Severe	Very severe	Test	P
Anxious mood	Controlled	22(55.0%)	15(37.5%)	3(7.5%)	-	-	4.02	0.13 (ns)
	Uncontrolled	21(35.0%)	31(51.7%)	8(13.3%)	-	-		
Tension	Controlled	21(52.5%)	17(42.5%)	2(5.0%)	-	-	6.63	0.036*
	Uncontrolled	19(31.7%)	29(48.3%)	12(20.0%)	-	-		
Fears	Controlled	24(60.0%)	15(37.5%)	1(2.5%)	-	-	4.21	0.12 (ns)
	Uncontrolled	25(41.7%)	29(48.3%)	6(10.0%)	-	-		
Insomnia	Controlled	20(50.0%)	15(37.5%)	5(12.5%)	0(0.0%)	-	11.6	0.009*
	Uncontrolled	13(21.7%)	25(41.7%)	19(31.7%)	3(5.0%)	-		
Intellectual	Controlled	3(7.5%)	25(62.5%)	12(30.0%)	0(0.0%)	-	16.2	0.001*
	Uncontrolled	9(15.0%)	15(25.0%)	29(48.3%)	7(11.7%)	-		
Depressed mood	Controlled	27(67.5%)	7(17.5%)	5(12.5%)	1(2.5%)	-	13.8	0.003*
	Uncontrolled	18(30.0%)	25(41.7%)	15(25.0%)	2 (3.3%)	-		
Behavior at interview	Controlled	29(72.5%)	10(25.0%)	1(2.5%)	-	-	9.22	0.010*
	Uncontrolled	25(41.7%)	31(51.7%)	4(6.7%)	-	-		
Psychosomatic	Controlled	35(87.5%)	4(10.0%)	1(2.5%)	0(0.0%)	-	9.86	0.020*
	Uncontrolled	35(58.3%)	20(33.3%)	4(6.7%)	1(1.7%)	-		
Psychomotor	Controlled	20(50.0%)	18(45.0%)	2(5.0%)	0(0.0%)	-	5.37	0.14 (ns)
	Uncontrolled	21(35.0%)	27(45.0%)	10(16.7%)	2(3.3%)	-		
Cardiovascular symptoms	Controlled	32(80.0%)	7(17.5%)	1(2.5%)	0(0.0%)	0(0.0%)	9.65	0.030*
	Uncontrolled	30(50.0%)	23(38.3%)	5(8.3%)	1(1.7%)	1(1.7%)		
Respiratory symptoms	Controlled	15(37.5%)	21(52.5%)	4(10.0%)	0(0.0%)	0(0.0%)	5.38	0.14 (ns)
	Uncontrolled	12(20.0%)	34(56.7%)	13(21.7%)	0(0.0%)	1(1.7%)		
Gastrointestinal symptoms	Controlled	4(10.0%)	28(70.0%)	8(20.0%)	0(0.0%)	-	4.15	0.24 (ns)
	Uncontrolled	3(5.0%)	36(60.0%)	18(30.0%)	3(5.0%)	-		
Genitourinary symptoms	Controlled	20(50.0%)	19(47.5%)	1(2.5%)	-	-	8.93	0.011*
	Uncontrolled	13(21.7%)	43(71.7%)	4(6.7%)	-	-		
Autonomic symptoms	Controlled	25(62.5%)	15(37.5%)	0(0.0%)	-	-	12.27	0.002*
	Uncontrolled	18(30.0%)	36(60.0%)	6(10.0%)	-	-		

Table (7): comparison between studied groups as regard disordered eating.

		Controlled		Uncontrolled		Statistics	
		No.	%	No.	%	X2	P
Disordered Eating	Positive	4	10.0%	32	53.3%	19.56	0.001*
	Negative	36	90.0%	28	46.7%		

4. Discussion

In the present work, 40 patients had controlled diabetes (HA1c ≤ 8) (Group C) and 60 patients had uncontrolled (group UC) diabetes.

In the present work, there was statistically significant increase of children with absent depression in controlled when compared to uncontrolled groups (95.0% vs 55.0% respectively). In addition, there was statistically significant decrease of mild and moderate depression in controlled when compared to uncontrolled group (5.0%, 0.0% vs 25.0% and 20.0% respectively). The total incidence of depression in studied populations was 29% regardless of the grade. These results are in agreement with Northam et al. (2005) who reported that, depression and diabetes distress are both prevalent in the individuals with T1D.[3] in addition, these results are consistent with Lašaitė et al. (2016) who reported that, principal findings of their study revealed that high overall diabetes distress score, suggesting clinical distress, was found in as much as 22.8% of young people with T1D.[4]

Fisher et al. (2012) found nonlinear relationship of diabetes-specific emotional distress with HbA1c, diet, self-efficacy, and physical activity, with stronger relationships for lower levels of diabetes-specific distress. It was suggested that diabetes distress is not only burdensome itself, but also may impede the self-

care behaviors of patients, thereby compromising glycemic control.[5] These results are consistent with that of the present work.

Another study of 349 children and adolescents with T1DM and 401 children without diabetes in Kuwait reported that, the median scores of anxiety and depression were significantly higher in the diabetic children, with greater distress related to worsening glycemic control.[6]

Lustman et al. (2000) demonstrated that depression was associated with poor metabolic control. Conversely, poor glycemic control could affect susceptible individuals and further increase the prevalence of depression.[7]

A meta-analysis spanning 30 years reported that compared with non-depressed patients, the odds that depressed patients will be noncompliant with medical treatment recommendations were 3 times greater.[8]

Furthermore, **Kongkaew et al. (2014)** reported that, their systematic review and meta-analysis suggests that depression is moderately associated with non-adherence to treatment in diabetic children and adolescents based on patient self-report. [9]The findings are consistent with those of a previous meta-analysis by **Gonzalez et al. (2008)** based on ten studies where the effect size was 0.29 compared to the effect size of 0.22 in Kongkaew et al. (2014) meta-analysis.[10]

The previous data demonstrates that depression may be one of the underlying and persisting risks which compromise the treatment of juvenile T1DM patients. These findings have practical implications for juvenile diabetic patients where routine psychological assessment will identify those at risk of depression and facilitate prevention of depression, hence improving treatment.

As regard to results Hamilton anxiety rating scale, there was statistically significant increase of anxiety, insomnia, memory defects, depressive mode, behavioral problems, psychosomatic disorders, heart and blood vessels manifestations, genitourinary manifestations, and autonomic nervous system manifestations in uncontrolled when compared to controlled group.

These results are in agreement with previous studies reported that, looking at symptoms of anxiety, correlations of STAI (C) with Hb A1c and BGMF were low but statistically significant.[11,12,13] Hilliard et al. (2011) showed that STAI (C) scores were significant predictors of HbA1c, and a 14-point increase in anxiety scores was associated with a clinically meaningful rise of 1% in HbA1c. Using the CBCL, Abdul-Rasoul et al. (2010) found a higher frequency of borderline (T-scores 67–70) and symptomatic anxiety (T-score above70) in patients with an HbA1c > 8.5% (>69 mmol/mol) ($p < 0.001$ and $p < 0.01$).[14] Using the BAI-Y, Kristensen et al. (2014) demonstrated a low but statistically significant positive correlation between anxiety symptoms and HbA1c.[15]

As regard to disordered eating, there was statistically significant decrease of disordered eating in controlled when compared to uncontrolled group (10.0% vs 53.3% respectively). The total prevalence of disordered eating was 36%. These results are in agreement with previous studies that have shown that young women with T1D are twice as likely as their non-diabetic peers to develop an eating disorder and that the prevalence of DEBs is as high as 31% to 40% in adolescents and women ages 15 through 30 years with T1D.[16]

In addition, in prospective study of 87 adolescents with T1D, **Peveler et al. (2005)** reported that 26% of their sample had clinical eating disorders or evidence of binging or purging, with 35% of their sample reporting omitting insulin for weight control.[17] Additionally, poor metabolic control not only increases the risk that someone with diabetes will require hospitalization, but the actual hospitalization costs are higher if a patient has an elevated HbA1c level.[18,19,20]

In addition, results of the present study are in agreement with **Doyle et al. (2017)** who reported that, HbA1c levels were markedly raised in DEPS-R (+) participants compared with participants with lower DEPS-R scores.[21] Thus, the relatively common occurrence of DEB may be an important contributor to poor glycemic control and one reason why so few with T1D in the 18 through 29–year age range are able to achieve target HbA1c levels of less than 7.0%, as recently reported by the Type 1 Diabetes Exchange Network.[22,23]

5. Conclusion

Depression, anxiety and eating disorder were higher among patients with type-1 diabetes; and all were associated with poor diabetic control. That's why for those with psychiatric symptoms, psychiatric consultation is necessary at a very early stage, particularly, patients with anxiety, depression and eating disorders since metabolic control of these patients is liable to worsen.

6. Recommendations

- All patients with long duration type1 diabetes should be screened for psychiatric disorders.
- Treatment of type 1 diabetes requires a team work consisting of a pediatrician, nurse, psychiatric and nutrition specialists.
- Another large study to show whether the psychiatric disorders is a cause or a result of poor glycemic control in patients with type 1 diabetes.

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