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Anxiety, depression, and glycemic control during Covid-19 pandemic in youths with type 1 diabetes

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Abstract

Objectives: Our study aims to assess the impact of lockdown during the coronavirus disease 2019 pandemic on glycemic control and psychological well-being in youths with type 1 diabetes.
Methods: We compared glycemic metrics during lockdown with the same period of 2019. The psychological impact was evaluated with the Test of Anxiety and Depression.
Results: We analyzed metrics of 117 adolescents (87% on Multiple Daily Injections and 100% were flash glucose monitoring/continuous glucose monitoring users). During the lockdown, we observed an increase of the percentage of time in range (TIR) ($p<0.001$), with a significant reduction of time in moderate ($p=0.002$), and severe hypoglycemia ($p=0.001$), as well as the percentage of time in hyperglycemia ($p<0.001$). Glucose variability did not differ ($p=0.863$). The glucose management indicator was lower ($p=0.001$). 7% of youths reached the threshold-score (≥115) for anxiety and 16% for depression. A higher score was associated with lower TIR [$p=0.028$, $p=0.012$].
Conclusions: Glycemic control improved during the first lockdown period with respect to the previous year. Symptoms of depression and anxiety were associated with worse glycemic control; future researches are necessary to establish if this improvement is transient and if psychological difficulties will increase during the prolonged pandemic situation.

Keywords: adolescents; anxiety; Covid-19; depression; type 1 diabetes.

Introduction

The ongoing coronavirus disease 2019 (Covid-19) pandemic [1] forced a lot of countries to establish a lockdown in order to limit the transmission of the disease [1].

The Italian Government organized the shutdown of school from February 24th, and lockdown from March 5th. In this context, healthcare professionals adopted telemedicine to facilitate continuity of care [2].

The social restrictions triggered negative psychological effects, such as anxiety, anger, sleep disorders, depression, and post-traumatic stress disorder (PTSD) [3].

In youths with diabetes, mental health condition, in particular anxiety and depression, is associated with increased risk of short and long-term complications such as weight gain, severe hypoglycemia and hyperglycemia [4].

We conducted a tele-homecare program that included the analysis of diabetes data through flash glucose monitoring/continuous glucose monitoring (FGM/CGM). We also evaluated psychological outcomes using the Test of Depression and Anxiety Scale (TAD) [5].

Our study aims to assess the impact of the Covid-19 pandemic, and consequent lifestyle changes, on glycemic control and psychological well-being in youths with T1D.

Methods

We followed a cohort of youths with type 1 diabetes (T1D) of the Pediatric Diabetes Unit, University Hospital of Padova. Inclusion criteria were age 12–20 years old, T1D duration of ≥1 year at enrollment, daily insulin dose of ≥0.5 units/kg, FGM/CGM use for at least 12 months,

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with time of use at least of 75%, maintaining the same device. All patients and parents gave written informed consent and they accepted to download data on software Diasend (Askim, Sweden) and/or Libreview (Abbott, IL, USA).

We analyzed standardized CGM metrics: mean glucose, coefficient of variance (CV), time in range (TIR): percentage of readings and time 70–180 mg/dL, Time Above Range (TAR): percentage of readings and time >180 mg/dL and Time Below Range (TBR): percentage of readings and time 54–69 or <54 mg/dL, Glucose Management Indicator (GMI) [6]. We evaluated 2-week data captured during the period from 30th of March to 12th of April, 2020, comparing them to the same period of the previous year. Psychological data were collected from 30th of March to 12th of April, 2020. TAD questionnaire was sent to the patients by e-mail. All participants completed autonomously the questionnaires. We contacted patients by phone to invite them to participate in the study.

To evaluate psychological symptoms it was used TAD [5], a measure to screen the presence of anxiety and depression disorders in children and adolescents. The test is a multidimensional standardized diagnostic questionnaire approved for children and youths from 6 to 19 years, exploring emotions, thoughts, and behaviors. This self-report is used for clinical and research either in healthy children and in children with chronic conditions. We used only the children and adolescents self-report scale. It includes 22 four-point Likert items providing a score of depression (11 items) and anxiety (11 items), with separate results for depression and anxiety. Standard scores, with a mean of 100 and a standard deviation of 15, were calculated for each participant. A standard score equal to or higher than 115 indicates the presence of clinical depressive and anxious symptoms. In the present study (n=117), Cronbach's alpha reliability values were 0.82 for depression score and 0.81 for anxiety score.

The primary outcome was a change in percentage TIR from pre-lockdown to lockdown period. Secondary endpoints were percentage changes in TAR, TBR, GMI, CV [6], and the association between TAD scores and TIR.

Statistical analysis

Results are presented as mean ± standard deviation or median [25th, 75th percentile] as appropriate. Not normally distributed variables were analyzed by Kruskal–Wallis test, while normally distributed variables were analyzed by the use of t-test, categorical variables were compared using Chi-square test. Analyses were performed using STATA.13 software (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP).

Results

Baseline characteristics of participants

A total of 117 youths with T1D (52 female, 65 male) participated in the study. The characteristics of the cohort are displayed in Table 1. None of the participants was diagnosed with Covid-19 infection during the study and none of the participants had a neuropsychiatric illness with active pharmacotherapy.

Table 1: Baseline characteristics of the patients.

Baseline characteristics (n 117)	
Age, years	
Mean ± SD	15.9 ± 2.3
Range	12–20
Sex (M) (n, %)	65 (56)
BMI, kg/m^2	22.2 ± 3.6
BMI z-score	0.008 ± 1
Weight, kg	61.7 ± 13.8
Tanner stage (n, %)	
II–III	5 (4)
IV–V	112 (96)
Insulin administration (n, %)	
CSII	15 (13)
MDI	102 (87)
Duration of diabetes, years	
Mean ± SD	7.9 ± 4.6
Range	1–18
HbA_{1c}, %	7.6 ± 1.2
HbA_{1c}, mmol/mol	51.3 ± 9.7

BMI, body mass index; CSII, Continuous Subcutaneous Insulin Infusion; MDI, Multiple Daily Injections; SD, standard deviation.

The participants used a iCGM (intermittently scanned, Abbott FreeStyle Libre) or an rtCGM (real-time, Medtronic Guardian, or Dexcom G6) for those in Continuous Subcutaneous Insulin Infusion (CSII): FreeStyle (87%), Medtronic Guardian (10%), Dexcom G6 (3%), with capillary blood glucose measures in accordance with the product license. Everyone used the accompanying receivers/mobile phone and changed the sensor according to the license (every 14 days for Abbott Freestyle Libre, every 7–10 days for Medtronic Guardian or Dexcom G6) or sooner in the event of sensor failure. Every participant had been using the same system for glucose monitoring for at least 1 year prior to the study.

Glycemic outcomes

The median percentage of time in target glycemic range during lockdown increased by 10% with respect to the control period (59% [47, 74] vs. 49% [39, 66], p<0.001) (Figure 1), with a significant reduction of both times in moderate (p=0.002), and severe hypoglycemia during the lockdown phase (p=0.001), as well as the percentage of time in hyperglycemia (p<0.001). CV did not differ between the two time-lapse (p=0.863). GMI was lower during the lockdown phase than in the control period (GMI 7.0% [6.5, 7.6] vs. 7.6% [7.1, 8.2], p=0.001).

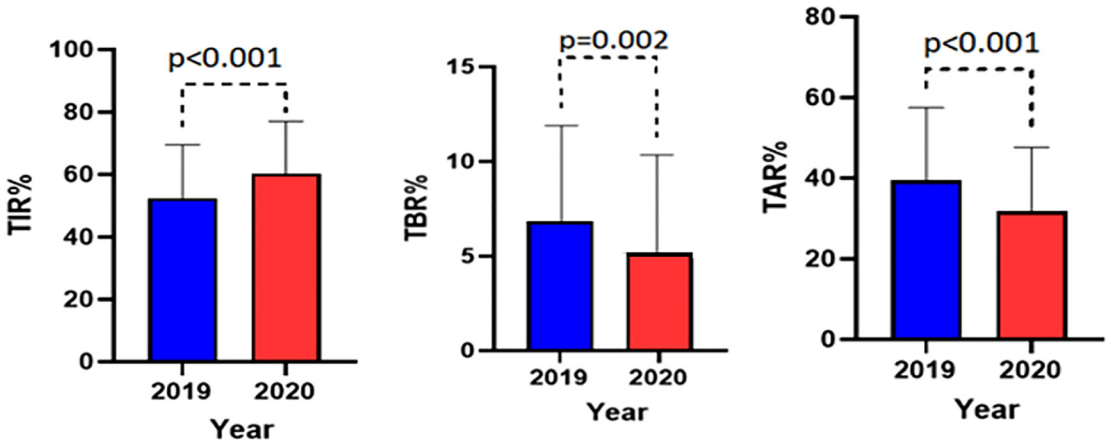

Figure 1: Percentage of time in range (70–180 mg/dL), time below range (<70 mg/dL), and time above range (>180 mg/dL) in the two considered timepoints.

By analyzing the composition of the population with augmented TIR there were no differences for age, gender, CSII utilization, and physical activity. There was a significant difference in the duration of diabetes (p=0.01). Children with a more recent diagnosis of diabetes have a bigger increase in TIR.

We divided into groups: adolescents (12–17 years) improved their TIR during lockdown (p<0.001) just like young adults (18–20 years) (p=0.0015).

Glycemic control and psychological symptoms

Fourteen youths (16%) resulted to have a significant score for depression and six for anxiety (7%). A higher score for depression and anxiety was associated with lower TIR (−0.22 ± 0.09, p=0.012 for depression and −0.20 ± 0.09, p=0.028 for anxiety, respectively, when adjusted for age, sex, diabetes duration) (Figure 2).

After the exclusion of those ones with positive scores for anxiety and/or depression (n=6 for anxiety and n=14 for depression, with four being positive for both), the difference between TIR pre-lock down and post-lockdown was still significant (p<0.001).

Discussion

This study points out potential factors affecting adherence to treatment and glycemic control. Our data show that during the lockdown, the percentage of TIR increased significantly with a reduction of time in hypoglycemia and hyperglycemia. As a consequence, GMI was lower during the lockdown phase than in the control period.

These findings are in line with recent literature in pediatrics [7, 8], reporting that people with T1D who stayed at home during lockdown improved their glycemic control, compared with metrics before the pandemic. Instead, analyzing data during the pandemic but before and during lockdown the differences are not so significant [9, 10].

Psychological reactions to a prolonged pandemic situation could affect glycemic control: depressive and anxiety symptoms could represent confounding factors in order to understand adolescent's adherence to T1D during this period.

Our results demonstrate that adolescents with symptoms of anxiety and depression exhibited lower TIR during the Covid-19 outbreak than peers without internalized symptoms. This is consistent with previous studies that highlighted the associations between poor mental health, poor glycemic control, and diabetes treatment among patients [11]. In particular depression, symptoms are associated with the worst adherence to diabetes treatment [12]. This aspect underlines the necessity of psychological screening of adolescents with T1D in order to prevent not only psychological disorders but also diabetes complications, in particular during stressful events. Indeed Covid-19 outbreak constitutes a risk factor for psychological maladjustment in adults and children, leading to an increase of psychological disorders in the pediatric population [3]. In particular, one study used the same questionnaire (TAD) in healthy children and showed that anxious condition was a predictor of videogame use and addiction during the Covid-19 pandemic [13]. We can hypothesize that the improved glycemic control observed in our cohort results from four main factors: a more regular lifestyle, including

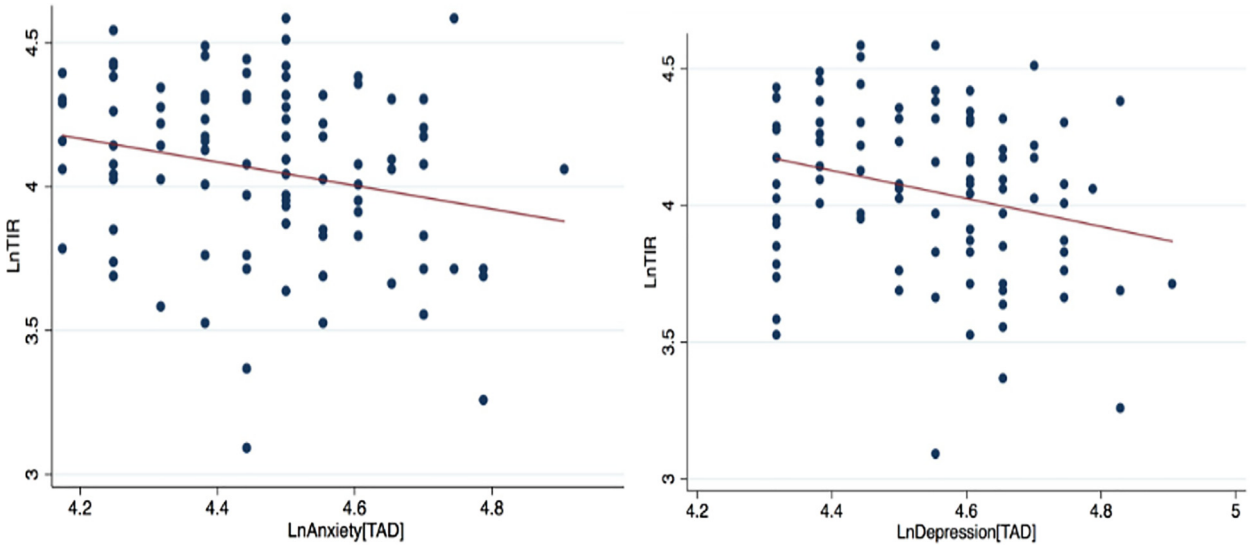

Figure 2: Correlation between anxiety and depression (Test of Anxiety and Depression score) with time in range (2020).

reproducible mealtimes and more attention on self-care [14]; an increased parental control [15]; the awareness that diabetes could worsen the outcomes of Covid-19 [16]; the low prevalence of psychological disorders in our cohort.

A longitudinal psychological assessment will be important to understand potential mental effects due to a prolonged pandemic situation. In fact, the glycemic benefit could constitute only a transient improvement due to a passing focus on health issues or to the abnormal situation of constant parental presence. Future researches will be needed to observe long-term trajectories of glycemic control and psychological effects in a prolonged pandemic situation. This study has limitations related to the short follow-up period and to the lack of psychological assessment measured with the same scale at baseline (2019). However, our cohort was periodically assessed with different psychological tools and clinical interviews and we can estimate a prevalence of depression symptoms lower than of 2% and anxiety symptoms lower than of 3%. The higher prevalence of anxiety and depression recorded in our cohort could be due to the Covid-19 pandemic but the absence of the same evaluation at baseline did not allow us to address this point. Aware of the difficult moments of lockdown, all participants were invited to participate in small groups via telemedicine to share experiences and promote mutual help between peers. Patients who have reached high levels of depression and anxiety to the questionnaire were invited to start cognitive-behavioral therapy.

The strengths of our study are the use of analysis of sensor-derived glycemic metrics and the influence of psychological symptoms in order to better understand adolescents' well-being with T1D.

Conclusions

Our data show that during the lockdown, TIR increased significantly with a reduction of the percentage of time in hypoglycemia, hyperglycemia, and GMI than in the control period. Furthermore, adolescents with symptoms of anxiety and depression present lower TIR during the Covid-19 outbreak than peers without internalized symptoms. Our results underline the importance of psychological screening in the pediatric population during stressful events, such as social isolation, in order to prevent psychological maladjustment and poor glycemic control.

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Author contributions: MC, MM, and CM designed the study; MC, CG, LT, and ER enrolled the patients and conducted project administration; MM, AS, and GD collected patients' data; MC and MM analyzed the data; MC and MM reviewed the literature and drafted the manuscript; and CM contributed to data interpretation and critical review of the manuscript. All authors have read and agreed to the published version of the manuscript.
Competing interests: Authors state no conflict of interest.
Informed consent: Informed consent was obtained from all individuals included in this study.
Ethical approval: The local Institutional approved the study.

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