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Duality of development and manifestations of PTSD in children with type 1 diabetes during the war in Ukraine

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Abstract: *in 2019, there were 207,383 registered patients with diabetes in Ukraine, of whom 58,954 had type 1 diabetes.The significance of this issue is directly linked to the strong association between the diagnosis of type 1 diabetes and the development of post-traumatic stress disorder (PTSD), the prevalence of which is rapidly increasing due to the full-scale war in Ukraine. According to recent domestic studies, approximately 25% of Ukraine's population experiences PTSD, and nearly half (57%) are at risk of developing it. The purpose of our study was to examine literature regarding PTSD progression and its impact on children with type 1 diabetes. According to the findings, there are two types of connection between diabetes and PTSD. The first type is based on the physiological response to traumatic stressors, where prolonged exposure of trauma and stress can lead to chronic diseases. The second type of connection indicates that PTSD may develop as a result of an established diagnosis of type 1 diabetes and can by itself directly contribute to PTSD development and progression in patients and their family members. More than 14% of children with type 1 diabetes have associated psychological disorders, such as anxiety, eating disorders, emotional instability, comorbid depression, attention and activity disorders.The practical work of pediatricians and endocrinologists requires a comprehensive, multidisciplinary team approach in treatment of these patients, involving psychologists and psychotherapists.*

Keywords: Post-Traumatic Stress Disorder (PTSD); Type 1 Diabetes; Children; Adolescents; Parents; dynamics.

Introduction

Type 1 Diabetes Mellitus is a metabolic disorder characterized by chronic hyperglycemia caused by dysfunction or complete insufficiency of insulin secretion and disruptions in carbohydrate, lipid, and protein metabolism [1]. Type 1 diabetes is one of the most common chronic diseases in infancy and the most frequent endocrinopathy in childhood. The global prevalence of type 1 diabetes is 5.9 per 10,000 individuals, with an incidence rate estimated at 15 per 100,000 individuals per year [2].

Post-Traumatic Stress Disorder (PTSD) is a group of persistent psychological and physiological symptoms that may develop after experiencing a traumatic event. Risk factors for PTSD include wars and armed conflicts, physical or sexual violence, being diagnosed with a chronic or life-threatening illness, terrorist attacks, and the death of loved ones. Symptoms

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of PTSD typically do not appear immediately but develop after some time – usually within three to six months.

Post-traumatic stress disorder is defined by four characteristic symptoms, including: persistent experience with intrusive memories, avoidance of thoughts about the past, negative mood and hyperarousal, causing clinically significant distress and/or functional impairment [3].

Research on pediatric medical trauma has primarily focused on life-threatening conditions (e.g., cancer, severe burns) rather than chronic illnesses such as diabetes. However, this topic demands closer attention, especially given the urgent current need arising from the rapid increase in cases of both PTSD and type 1 diabetes among children in Ukraine.

Aim

The aim of this study was to analyze the existing literature and outline the key aspects of the development and progression of PTSD in children with type 1 diabetes.

Materials and methods

A review was conducted of scientific publications indexed in international scientometric databases.

Review and discussion

According to the Association of research and development pharmaceutical producers (APRaD) and the Kyiv School of Economics (KSE) (2020), as of 2019, 207,383 patients with diabetes mellitus were registered in Ukraine (58,954 - type 1 diabetes mellitus) [1].

Stress is defined as a biological reaction triggered by any internal or external trigger. The ability to withstand stress responses is considered an evolutionary advantage, essential for survival, and represents an adaptive reaction. The so-called «fight or flight» reaction is a catabolic, anti-reproductive, anti-growth and immunosuppressive complex of mechanisms, is temporary and ensures survival [3].

Chronic stress can lead to detrimental consequences, affecting a significant role in the development of and acting as a provoking or aggravating factor. In addition, changes in the nature of the child's behavioral reactions, which are observed in stress disorders, for example, a sedentary lifestyle and eating habits (increasing portion size, abuse of «fast» carbohydrates), can result in weight gain and metabolic disorders.

The stress response system involves a complex neuroendocrine structure, including the central and peripheral nervous systems. Glucocorticoids (GCs) and catecholamines, which are the final mediators of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system, respectively, serve as primary hormonal effectors of the stress system. During chronic stimulation, stress hormones can negatively affect glucose homeostasis. In acute stress, glucose concentration and insulin secretion increase, facilitating glucose utilization and maintaining normoglycemia. When the stressor is chronic, the process becomes allostatic («stability through change»). The term «glucose allostasis» was first introduced in 2003, referring to situations where, under chronic stress (e.g., insulin resistance), glucose levels fail to return to baseline, continually signaling the β-cells about the need for insulin [4].

Type 1 diabetes (T1D) is a chronic autoimmune disorder characterized by the destruction of pancreatic β-cells, leading to hyperglycemia and a lifelong insulin-dependent state. Various factors, such as infections, diet, vitamin D deficiency, and gut microbiota, are considered environmental stressors that may trigger T1D in genetically predisposed individuals. Psychological stress has also been proposed as a possible trigger for T1D. The mechanism of stress-related onset of T1D involves elevated serum concentrations of glucocorticoids and catecholamines, which increase insulin demand and initiate insulin resistance. This theory is known as the «β-cell stress hypothesis». Additionally, autoimmune disorders, including T1D, are associated with increased production of pro-inflammatory cytokines, such as IL-1β [3-4]. A summarized schematic of the pathophysiological mechanisms of glucose metabolism disorders under stress conditions is provided in Figure 1.

Number of studies based predominantly on data obtained from patients who underwent standardized screening questionnaires during clinic visits showed main trends in PTSD among children and adolescens with T1D. The experience of psychological trauma, including PTSD, has been less studied among children and

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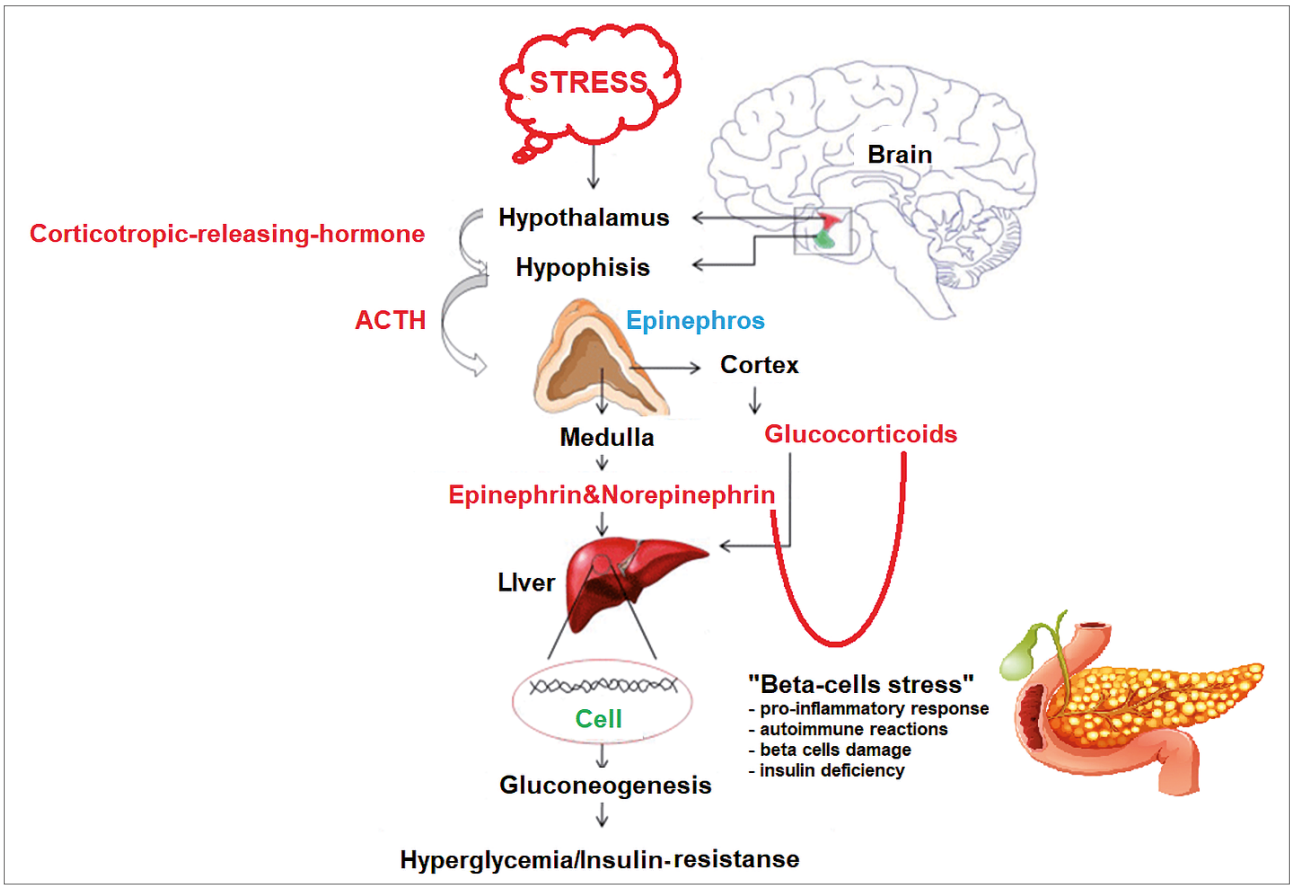

Figure 1. A summarized schematic representation of the pathophysiology of glucose metabolism disturbances under stress conditions

adolescents with type 1 diabetes. It is known that 61.8% of adolescents have experienced or are experiencing a potentially traumatic experience, with 8–10% developing post-traumatic stress disorder (PTSD). The statistical prevalence of PTSD in the general population in peacetime is relatively small and is 6–8% [5]. However, as a result of the full-scale war in Ukraine, the problem of PTSD is rapidly progressing. According to recent domestic studies, the prevalence of PTSD in Ukraine is about 25%, with almost half of the population (57%) at risk of its development. Type 1 diabetes is the most common form of diabetes in young people and one of the most common chronic diseases in children, adolescents and young people [6].

The relevance of this issue is also related to the direct close connection between a T1D and the development of PTSD. More than 14% of people with T1D experience co-occurring psychological disorders such as anxiety, eating disorders, emotional instability, comorbid depression, and attention deficit hyperactivity disorder (ADHD). This suggests that many children and adolescents with T1D exhibit symptoms directly related to the onset of PTSD (Figure 2) [5].

Two types of relationships between diabetes and PTSD are worth considering. The first type

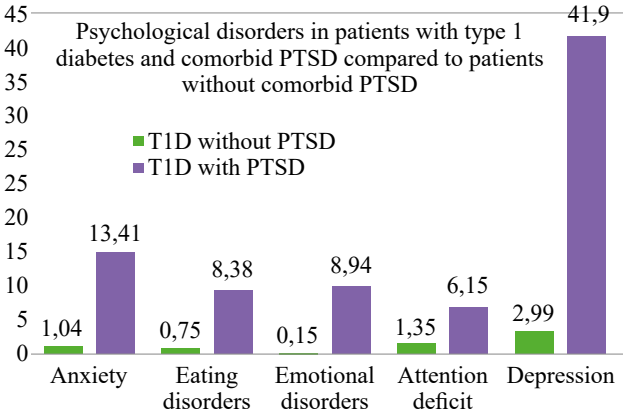

Figure 2. Spectrum of psychological disorders in children with type 1 diabetes(T1D) and comorbid PTSD compared to patients without comorbid PTSD [5].

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of relationship is due to the fact that the response to traumatic stressors has a physiological basis, which can subsequently lead to the occurrence of chronic diseases in a person. Long-term exposure to traumatic, stressful events (for example, child abuse) can serve as a trigger and lead to an increase in chronic diseases in society.

On the other hand, PTSD can develop as a result of an already established diagnosis of type 1 diabetes. Given that type 1 diabetes is a chronic disease, it can be a direct cause of the development of PTSD, both for patients and for their family members.

Studies of pediatric patients and/or their parents consistently show a direct sequence between the appearance of PTSD symptoms in patients with recently diagnosed chronic diseases [7]. This relationship is due to a number of life changes in the life of the child and the family as a whole. As children and adolescents are forced to adhere to a regimen and make major lifestyle changes: insulin injections, physical activity, and a healthy diet, in order to avoid episodes of extremely high or low glycosylated hemoglobin (HbA1c), both of which can be life-threatening [8].

Type 1 diabetes(T1D) and PTSD may have a reciprocal effect. The association of PTSD with a medical diagnosis of T1D may be perceived as a traumatic event and thus negatively affect medication intake and treatment regimen. Treatment of type 1 diabetes may indicate a reversal of the recall, which in turn may increase the avoidance behaviors characteristic of PTSD [5]. In patients with T1D, the trauma may be related to the diagnosis itself, such as hospitalization or glycemic values. Among those newly diagnosed with T1D, PTSD or acute stress symptoms related to the diagnosis have been reported. However, a significantly higher proportion of children, up to 30%, may have subclinical PTSD symptoms related to medical stressors during their illness.

Children with PTSD may have metabolic and neuroendocrine dysfunction that is not seen in individuals without PTSD. Several studies have shown that children with type 1 diabetes may have poor glycemic control associated with diabetes self-management, which includes blood glucose monitoring, insulin administration, and diet adherence [2-4]. A large registry of 13,316 children and adolescents with type 1 diabetes showed that only one-third of participants achieved glycemic targets, with even lower rates of glycemic target achievement among adolescents (43% vs. 21% for patients aged 6–12 and 13–19 years). Moreover, poor glycemic control in pediatric patients with T1D and PTSD increases the risk of acute metabolic complications such as diabetic ketoacidosis, hypoglycemic coma and hospital stay duration (Figure 3) [5].

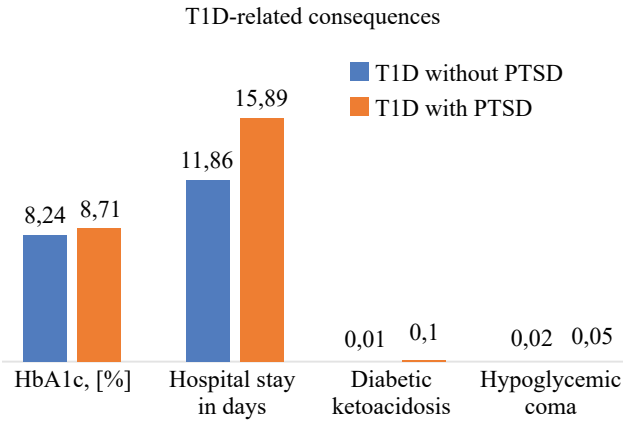

Figure 3. Diabetes-related consequences in patients with type 1 diabetes and comorbid PTSD compared to patients without comorbid PTSD [5]

Additionally, adolescents and young adults with type 1 diabetes and PTSD have been found to have higher BMIs and longer hospital stays compared to children and adolescents without PTSD [5].

It is also worth noting that the development of an acute or chronic illness of any etiology in children often triggers anxiety episodes and symptoms of post-traumatic stress in parents [8-9]. Studies of children and adolescents have shown that a diagnosis of diabetes in a child is associated with an increased prevalence of PTSD in parents. Ongoing treatment of type 1 diabetes can be extremely challenging for parents, as it requires family support for both physical and psychological care of the child. The literature suggests that parental responses to stress, anxiety, and depression are common after their children are diagnosed with diabetes, especially regarding thoughts of potential acute complications [8,10].

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Parental stress and PTSD may also negatively impact child health. Managing parental stress symptoms may lead to improved behavioral and metabolic outcomes in children. Children of parents with PTSD had lower adherence to treatment than children of parents without PTSD [9].

Parents play an important role not only in the psychological impact on the child, but also in the management of treatment and monitoring aimed at maintaining balanced glycemic levels. The American Diabetes Association (ADA) suggests adopting a family-centered approach so that parental stress can be overcome by increasing parental self-efficacy, which represents the confidence associated with a sense of competence in performing a specific task for the child [10-11]. Parental stress has been defined as the perception by parents of an imbalance between the highly increased requests of parenting and available sources. Obviously, parents have to adapt their own life in order to manage their children's chronic disease. Therefore, they may experience different psychological symptoms, i.e. anxiety, stress and/or depression related to paediatric T1D. As a result the latter will influence the glycemic control of their children's diabetes. Studies on self-efficacy have suggested that it is an important construct for disease management within the health care setting in hospitals. Parental self-efficacy allows them to control the stressors and challenges related to T1D.

Different approaches may increase parental self-efficacy. i.e. family-focused interviews, consulting parents by psychologists during hospital stay and after the hospital discharge, telemedicine. Thus, parental self-efficacy has a positive impact on both parents and their children by allowing them to overcome stressors and problems associated with the diagnosis, thus contributing to better monitoring and treatment of children with type 1 diabetes [10-14]. The clinical and pathogenetic axis of development and formation of PTSD in children with type 1 diabetes is presented in Fig. 4.

Therefore, the literature analysis suggests that PTSD and Type 1 Diabetes (T1D) in children have a reciprocal, dual impact. This is related to the psychotraumatic effect of the T1D diagnosis itself, as well as the interdependent consequences it has on the course and compensation of T1D. Additionally, the impact extends to the involvement of family members in the psychotraumatic triangle, affecting not only the child but also family members.

Conclusions

Symptoms of PTSD are common in children with Type 1 Diabetes (T1D). PTSD triggered by T1D can negatively affect glycemic control and result in more frequent diabetic ketoacidosis episodes. It may also impair the patient's ability to engage in healthy self-care behaviors.

Two types of connection between diabetes and PTSD established, – the first type is based on the physiological response to traumatic stressors, the

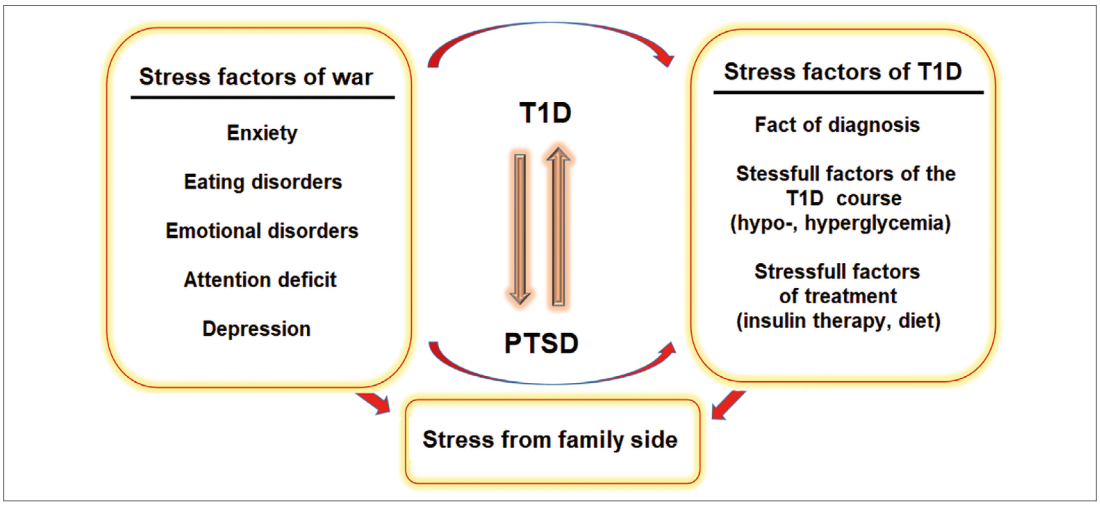

Figure. 4. Clinical-pathogenetic axis of development and formation of PTSD in children with type I diabetes

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second type of connection dealing with the fact that PTSD may develop and progress as a result of an established diagnosis of type 1 diabetes.

The practical activities of pediatricians and endocrinologists should take into account the potential risks and duality of PTSD development in children with type 1 diabetes, including multidisciplinary tactics for managing such patients and involving psychologists and psychotherapists.

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Conflict of interest

There are no conflicts of interest in the presented work.

Consent to publication

All authors have read and approved the final version of the manuscript. All authors have agreed to publish this manuscript.

ORCID ID and authors input

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Дуальність розвитку та проявів ПТСР у дітей з цукровим діабетом І типу під час війни в Україні

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Анотація: *Станом на 2019 рік в Україні зареєстровано 207383 пацієнти з цукровим діабетом з яких 58954 – цукровий діабет 1-го типу. Важливість проблеми пов'язана з безпосередньо тісним зв'язком між діагнозом цукровий діабет 1 типу та виникненням посттравматичного стресового розладу (ПТСР), поширеність якого стрімко зростає в результаті повномасштабної війни в Україні. Відповідно до сучасних вітчизняних досліджень, розповсюдженість ПТСР в Україні становить близько 25% , причому майже половина населення (57%) перебуває в зоні ризику його розвитку. Метою нашого дослідження було вивчити дані літератури стосовно особливостей перебігу ПТСР та його вплив на дітей з цукровим діабетом 1 типу. Відповідно до результатів, варто розглядати два типи взаємозв'язку між цукровим діабетом і ПТСР. Перший тип зв'язку обумовлений тим, що реакція на травматичні стресори, має фізіологічну основу і в подальшому, внаслідок тривалого впливу травматичних, стресових події, може призвести до виникнення хронічних захворювань. Другий тип взаємозв'язку полягає в тому, що ПТСР може розвинутися в результаті вже встановленого діагнозу цукровий діабет 1 типу, що є безпосередньою причиною виникнення та прогресування ПТСР, як для пацієнтів так для членів їхніх сімей. Понад 14% дітей з цукровим діабетом 1 типу мають супутні психологічні розлади, такі як тривога, розлади харчової поведінки, емоційна нестабільність, коморбідна депресія, розлад уваги та активності. Практична робота педіатрів та ендокринологів вимагає комплексного командного мультидисциплінарного підходу в терапії таких пацієнтів та залученням психологів та психотерапевтів.*

Ключові слова: посттравматичний стресовий розлад (ПТСР), цукровий діабет І типу, діти, підлітки, динаміка, батьки.