

# COMPLETE EVALUATION OF THE MECHANISMS OF AUTONOMOUS REGULATION AND PSYCHOEMOTIONAL STATE IN ADOLESCENTS WITH MENSTRUAL CYCLE DISORDERS

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**Abstract:** Menstrual cycle disorders in adolescent girls represent an important medical and social problem that requires a comprehensive approach to diagnosis and treatment. The menstrual cycle is a key indicator of a woman's overall health, and its deviations can be related not only to endocrine pathologies but also to psycho-emotional and social factors. In this context, special attention should be paid to the study of the mechanisms of autonomous regulation and psycho-emotional state, as they play a significant role in the pathogenesis of menstrual disorders.

**Key words:** Menstrual cycle, adolescent girls, psycho-emotional disorders, central and peripheral systems.

**Introduction.** Autonomic regulation, which ensures the maintenance of the body's homeostasis, includes the interaction of the central and peripheral nervous systems, as well as the endocrine system, which can be disrupted under conditions of stress, emotional overload, and changes in lifestyle. Adolescents' psycho-emotional state also affects the functioning of their reproductive system. Studies show that depressive disorders, anxiety, and stress can lead to menstrual cycle disorders, which justifies the need for a detailed analysis of these relationships.

Adolescent girls experiencing menstrual disorders often experience severe stress, which can further exacerbate their psycho-emotional state. Therefore, it is important not only to identify the physical causes of disorders but also to assess the psychological and social aspects that influence the course of the menstrual cycle.

This work aims to fully assess the mechanisms of autonomic regulation and psycho-emotional state in adolescent girls with menstrual disorders. The study represents an attempt to integrate data on the body's physiological responses and psycho-emotional characteristics, which can help develop a holistic approach to helping such patients. Understanding these mechanisms will allow for the creation of effective therapy and rehabilitation strategies aimed not only at restoring the menstrual cycle but also at improving the overall health and psychological comfort of adolescent girls.

The puberty period in adolescent girls is a critical stage in the formation of the reproductive system, psycho-emotional sphere, and mechanisms of autonomous (vegetative) regulation. Menstrual cycle disorders (MSD) in adolescence are extremely common - according to the World Health Organization, 60-80% of girls have various deviations in the formation of the menstrual cycle, and 20-30% of disorders are persistent and require medical intervention (WHO, 2023). Despite their high prevalence, NMS has long been considered primarily within the framework of gynecology, without assessing

neuro-physiological and psychovegetative aspects. Foreign studies convincingly show that emotional stress, anxiety-depressive states, and impaired nutrition control affect hypothalamic-pituitary-ovarian regulation, leading to functional hypothalamic amenorrhea (FHA) due to the suppression of GnRH impulse secretion.

**The purpose of the study** was to determine the relationship between psychoneurological and vegetative changes in adolescent girls with menstrual cycle disorders and to assess the influence of psycho-emotional factors on the state of the autonomic nervous system and the clinical characteristics of the menstrual cycle.

### Research material and methods

The study was conducted in the form of cross-sectional comparative analysis based on the clinical department of the Multidisciplinary Clinic of Samarkand State Medical University; the school department (adult gynecologist's office together with the neurological/vegetative profile office), the city of Samarkand, and the pediatric gynecology and pediatric neurology departments of the Multidisciplinary Children's Hospital. The study included adolescent girls aged 12-17, who had menarche at least 12 months ago. The study was conducted for the period 2022-2025, the total number of examined adolescent girls was 217, and the introduction of primary examination and filling out questionnaires was preceded by the selection of precedents for further research.

In accordance with the set goal, two groups were formed from a total of 89 adolescent girls: The main group (G1) - adolescents with menstrual cycle disorders (irregular cycles more than 3 months, cycle interval  $<21$  or  $>45$  days, oligomenorrhea, II-III degree algodysmenorrhea), 53 patients. Comparison group (G2) - adolescents with regular menstrual cycle (duration 26-32 days during the last 6 months) - 36 patients. The main characteristic criteria for inclusion in the study were: age 12-17 years; presence of menstrual dysfunction; written informed consent of parents/legal guardians and verbal consent of the adolescent. From the total number of adolescent girls, the following indicators were excluded from the next stage of the study: endocrine diseases (hyperprolactinemia, hypothyroidism, diabetes mellitus; hormonal therapy for the last 6 months; identified genetic syndromes, organic diseases of the CNS; use of psychotropic drugs. In the second stage of the study, all adolescent girls (89) underwent clinical and neurological examination, which included a detailed history (menstrual age, cycle duration and regularity, severity of pain syndrome); anthropometry (BMI, body mass index); Ultrasound of the pelvic organs in dynamics (assessment of the follicular apparatus); characteristics of menstrual function (cycle diary); assessment of pain and severity of symptoms according to the MSQ scale - Menstrual Symptom Questionnaire. Since the purpose of the study was to study the psychoneurological and vegetative state, we used tests (scales) - questionnaires to determine the level of lability: HADS (Hospital Anxiety and Depression Scale) - the level of anxiety and depressive symptoms; PANAS - assessment of emotional reactivity; Test assessment of cognitive functions (Digit Span, Trail Making Test A/B). Heart rate variability (HRV) at rest and during the orthostatic test: indicators: SDNN, RMSSD, LF/HF; Kerdo index (vegetative tone); vegetative symptoms scale (VAS/A.M.Vein questionnaire). Laboratory diagnostics was carried out only for indications, to exclude the endocrine causes of NMS (FSH, LH, prolactin, TSH, free T4; ferritin and glucose on an empty stomach (to exclude iron deficiency and metabolic disorders). Statistical data processing was carried out on an individual computer, data analysis using SPSS/R, where comparison of quantitative variables was carried out using the Mann-Whitney t-test/U-criterion and Pearson/Spearman coefficient. To establish the relationship between NMS, anxiety, and HRV, it was appropriate to use logistic regression, taking  $p < 0.05$  as the statistical significance level.

**Research result.** The study, as noted above, included 89 adolescent girls. The main group consisted of 53 girls with menstrual cycle disorders (MSD), and the comparison group consisted of 36 girls with regular menstrual cycles. In most cases, girls and the main group complained of irregular cycles (intervals  $>45$  days or  $<21$  days), pronounced pain syndrome during menstruation (algodysmenorrhea), headaches of tension, especially in the pre-menstrual days, increased fatigue, decreased concentration of attention in lessons, alienation and lack of interest in studies, episodes of dizziness, a feeling of

heart palpitations, a "clamp in the throat" during a conversation or conversation with someone close to them. One of the adolescent girls initially had no menstruation, prolonged treatment by a pediatric gynecologist led to a positive result, the menstrual cycle normalized, however, against the background of "well-being," the patient developed epileptic seizures, which were replicated thanks to convulsant monotherapy. In the girls of the comparison group, the clinical picture was calmer, menstruation was regular, pain syndrome was minimal or absent, complaints of fatigue were found only during physical activity. In the main group, where adolescent girls had a combination of menstrual dysfunction signs with NMS, neurological manifestations of vegetative dysfunction were noted in the form of coldness of the hands/feet, orthostatic dizziness, pronounced emotional lability, and a tendency to tachycardia. From the gynecological side, the following symptoms were identified: late establishment of a regular cycle, with shortened or prolonged menstrual cycles, with a pronounced premenstrual symptom (PMS). That is, adolescent girls were characterized by a polysysemantic clinical picture involving neurovegetative regulation and the emotional sphere, as shown in Table 1.

**Table 1. General characteristics of the examined girls**

| Indicator                   | G1: NMS (n=53) | G2: Regular cycle (n=36) | p-value |
|-----------------------------|----------------|--------------------------|---------|
| Age, years                  | 14,6 ± 1,4     | 14,3 ± 1,2               | 0,284   |
| Menarche age, years         | 12,4 ± 0,8     | 12,1 ± 0,7               | 0,112   |
| Pain syndrome (NRS), points | 6,4 ± 1,8      | 3,1 ± 1,2                | <0,001  |

Despite the fact that in the main group, adolescent girls had the same age and practically identical menstrual cycle disorders, a significantly more pronounced pain syndrome was noted in this group ( $p < 0.001$ ). This reflects the clinical severity of the condition: in NMS, pain becomes not just an episode, but a factor affecting the overall level of nervous regulation, emotional background, and academic performance (frequent absences from classes).

As a result of analyzing the emotional state according to the proposed scales (questionnaires), it turned out that 70% of adolescent girls in the main group experience constant anxiety, waiting for menstruation or accompanying pain during menstruation. They described the condition as "fear of pain," "excitement when there is no cycle in time." All of this naturally forms chronic stress, which automatically activates the hypothalamus - the center that regulates both emotions and menstrual function. At the same time, against the background of NMS, high anxiety and fatigue are observed, and cognitive processes slow down. Girls are less focused, lose weight faster, and complain of forgetfulness. This explains the relationship between menstrual dysfunction or pain leading to anxiety, which gradually depletes the nervous system and available resources, ultimately all together reflecting on cognitive slowdown.

Thus, it is noted in the main group, where adolescent girls with menstrual dysfunction in combination with NMS have polysysemantic disorders (gynecological, psychoneurological, and autonomic). High anxiety and decreased cognitive stability were found, reflecting emotional tension, diagnosing the autonomic nervous system, confirming sympathicotonia and depletion of adaptive resources.

**Conclusions:** The study revealed that adolescent girls with menstrual cycle disorders had significantly higher levels of anxiety, emotional lability, fatigue, and reduced attention concentration compared to girls with regular menstrual cycles. It has been established that the severity of anxiety and depressive symptoms in adolescents with menstrual cycle disorders exceeds the threshold values of the HADS scale, which aligns with international research data, which emphasizes the role of psycho-emotional stress as a key factor in the dysregulation of the hypothalamohypophyseal-ovarian axis. Studies by foreign authors have shown that chronic emotional stress reduces the frequency of GnRH impulse secretion, decreasing the production of LH and FSH, leading to functional hypothalamic amenorrhea and irregular menstruation. In clinical observations of adolescents, it was established that anxiety and fear of expecting pain during menstruation can trigger recurring episodes of sympathetic hyperactivation and increased pain sensitivity. The obtained heart rate variability indicators (SDNN,

RMSSD, LF/HF) allow us to objectively confirm the presence of stress-oriented vegetative dysfunction in girls of the main group. They exhibited a significant increase in sympathetic tone and a decrease in parasympathetic activity, reflecting the chronic overstrain of adaptation mechanisms.

Similar data are presented in domestic and foreign studies, where changes in vegetative regulation are considered a key mechanism for the formation of pain, fatigue, and emotional instability in adolescents with menstrual cycle disorders. It is important to note that the study revealed a clear correlation between anxiety levels and autonomic regulation indicators (LF/HF and SDNN). The higher the anxiety in a teenager, the more pronounced the sympathicotonia and the lower the compensatory reserve of the autonomic nervous system. These data confirm the relationship between psycho-emotional state and neurovegetative regulation in menstrual cycle control. Similar results are presented by Russian researchers, describing the combination of algodysmenorrhea, anxiety disorders, and vegetative instability. Uzbek authors also note that adolescents with NMS often experience symptoms of autonomic dysfunction, however, most publications lack a comprehensive neuro-physiological approach, including HRV and cognitive function assessment. Thus, the study fills the existing gap by demonstrating a correlation between clinical gynecological manifestations, psycho-emotional state, and objective parameters of autonomic regulation. These results confirm the need for an interdisciplinary approach in the management of adolescent girls with cycle disorders. It is important not to limit oneself to gynecological examination, but to assess the psycho-emotional state, the variability of heart rhythm, and the parameters of vegetative tone. Using such approaches contributes to a reduction in sympathoadrenal load, normalization of hypothalamic rhythms, and restoration of menstrual function.

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