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Prediction Of Delayed Puberty In Adolescent Girls

Gulistan Bekbaulieva

Professor, Doctor of Medical Sciences, Department of Obstetrics, Gynecology, and Reproductology, Tashkent State Medical University, Tashkent, 100105, Uzbekistan

Bekposhsha Kadirova

Master's Student, Department of Obstetrics, Gynecology, and Reproductology, Tashkent State Medical University, Tashkent, 100105, Uzbekistan

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Abstract: The adolescent period is a fundamental stage in the formation of reproductive health and the reproductive potential of women of fertile age. Consequently, an in-depth study of adolescent girls during puberty and the identification of delayed puberty (DP), taking into account possible etiopathogenetic factors of its development, will allow for the development of predictive methods and scientifically substantiate the identification of risk groups, thereby contributing to the preservation of reproductive potential. The objective of this study was to develop a scientifically based, comprehensive approach to the diagnosis and prediction of DP in adolescent girls, considering the functional state of the somatic and reproductive systems. At the screening stage for detecting DP, 115 adolescent girls (aged 14–18 years) from School No. 83 in Tashkent were enrolled. In the second stage, 48 girls were selected for the main group, along with 50 healthy adolescent girls (control group) who had no delays in pubertal development and presented with a normal menstrual cycle. A comprehensive analysis of the universal screening results established that the prevalence of delayed puberty (DP) among girls aged 14–18 years was 13.9% ± 0.9%; specifically, signs of Grade I DP were observed in 7.82% ± 1.9%, Grade II DP in 4.34% ± 1.5%, and Grade III DP in 1.73% ± 2.4% of cases. An integrated assessment of risk factors revealed that the most significant factors were a combination of a history of infectious diseases with acute and chronic tonsillitis (relative risk weight index R=2.0), the presence of thyroid pathology during puberty (R=2.04), mental and physical strain (R=1.82), age at menarche (R=1.79), and socioeconomic and living conditions (R=1.67). By calculating the total sum of R (ΣR) for all factors (18.49) and determining the sum of the maximum and minimum values of the prognostic coefficients, the boundaries of the risk ranges (Pmin and Pmax) for the development of DP in adolescent girls were established. Consequently, we have developed criteria for predicting delays in pubertal development, which ensure the identification of risk groups for the development of DP.

Keywords: Adolescent girls, delayed puberty, prediction of delayed puberty, risk group and risk factors for delayed puberty.

Introduction: The WHO notes an acute need to increase resources worldwide by almost 1.3-fold to address emerging risks threatening adolescent health (aged 10–19 years), as well as to solve pressing tasks for protecting the mental, sexual, and reproductive health of adolescents [9]. Currently, the Global Action for Measurement of Adolescent Health (GAMA) Advisory Group has been established in collaboration with WHO, UNAIDS, UNESCO, UNFPA, UNICEF, UN Women, the World Bank Group, and other organizations, with the aim of optimizing adolescent health assessment based on 47 indicators [8].

The adolescent period is a fundamental stage in the formation of reproductive health and the reproductive potential of women of fertile age [6, 7, 4]. Consequently, the physical and sexual development of adolescents is of particular importance for understanding the pathogenesis of many pathological

processes diagnosed in adulthood. However, despite the known adverse consequences of delayed puberty (DP) in girls, even its pronounced forms are diagnosed relatively late, and less manifest presentations are often overlooked entirely, which hinders the prevention of reproductive system disorders [1, 2, 3, 5]. In the Republic of Uzbekistan, data regarding the frequency and prevalence of delayed puberty are lacking, and there is no clear understanding regarding the proportion of its various forms. In this regard, an in-depth study and comprehensive diagnosis of DP, taking into account possible etiopathogenetic factors of development, will allow for the development of predictive and early diagnostic methods, scientifically substantiate the identification of risk groups, and thereby reduce morbidity in adolescence.

The objective of the study was to develop a scientifically based, comprehensive approach to the diagnosis and prediction of delayed puberty (DP) in adolescent girls, considering the functional state of the somatic and reproductive systems.

METHODS

At the screening stage for detecting DP, 115 adolescent girls (aged 14–18 years) from School No. 83 in Tashkent were enrolled. In Stage II, 48 girls were selected for the main group, as well as 50 healthy adolescent girls (control group) with no delay in pubertal development and a normal menstrual cycle.

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$n = \frac{t^2 pq}{\Delta^2}$, where n is the required number of observations.

Assuming a 99% probability of an accurate prediction (t = 2.5), a maximum ratio of indicators P and q (50 × 50 = 2500) and a confidence interval (margin of error) of Δ = 5%, the sample size should be at least 625 subjects. The anamnesis of the examined girls regarding infectious and other extragenital diseases suffered in childhood was studied. These data were compared and verified against the history in their outpatient medical records.

RESULTS AND DISCUSSION

Our comprehensive analysis of the results from the universal screening of all studied indicators established that nearly one-third of the examined adolescents exhibit certain abnormalities in pubertal development. Thus, the prevalence of delayed puberty (DP) among girls aged 14–18 years was noted in 13.9% ± 0.9%. Specifically, signs of Grade I DP (a delay in sexual development of 2–2.9 years) were observed in 7.82% ± 1.9% of the examined girls. Grade II DP (a delay in sexual development of 2.9–4 years) was determined in 4.34% ± 1.5% of the examined girls. Grade III DP (a delay in sexual development of more than 4 years) was detected in 1.73% ± 2.4% of cases among adolescent girls (Fig. 1).

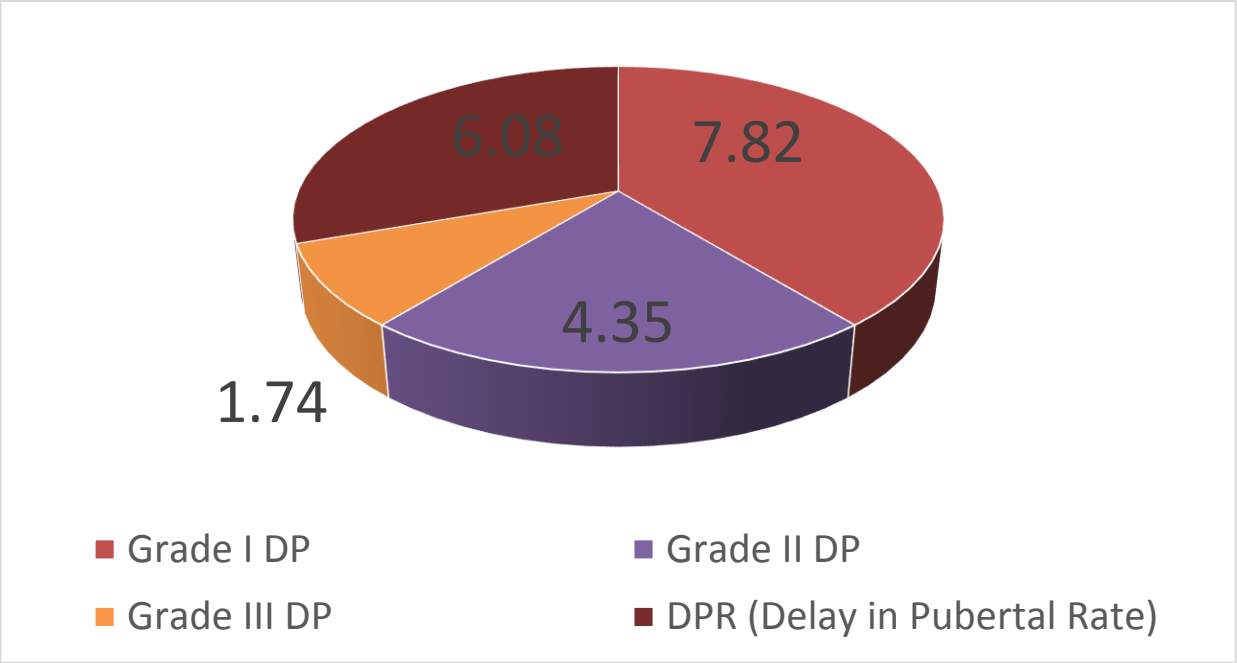

Fig. 1. Frequency and prevalence of delayed puberty among adolescent girls (%).

Analysis of infectious and viral diseases transmitted in childhood and the prepubertal period showed that chronic tonsillitis, anemia, and rheumatism were detected with practically equal frequency in the studied groups of girls with DP. At the same time, the incidence of thyroid gland diseases is noteworthy: 45.4% ± 4.6% in the Grade II DP group and 46.1% ± 4.2% in the Grade I DP group. However, it is noteworthy that girls with Grade II DP suffered from infectious and viral diseases more frequently, specifically chickenpox (1.79 times more often) and epidemic parotitis (mumps) (1.9 times more often) compared to girls with Grade I DP.

We conducted an integrated assessment of the risk factors identified for the development of DP pathology and developed a prognostic table for individual prediction (Table 1). It is established that the probability of pathological risk is influenced not only by biomedical factors but also by a complex of other factors, including social ones. Each of these has a specific "weight" in the development of DP. Therefore, the prognostic table includes the prognostic coefficients of selected risk factors for reproductive system disorders in adolescents, with their weighting coefficients calculated beforehand.

Table 1

Integrated assessment of risk factors for menstrual function disorders (prognostic table)

Factors	Relative Risk Indicator (**R**)	Prognostic Coefficient (**X**)
Age	1,30	1,53
Body mass deviations from the mean (±2σ)	1,38	1,79
Age at menarche: 16-17 years	1,79	1,84
History of acute tonsillitis (chronic tonsillitis)	2,0	3,54
History of 2-3 infectious diseases	1,32	1,56
History of inflammatory extragenital diseases (EGD)	1,39	1,74
Thyroid pathology at present	2,04	3,24
Mental and physical strain	1,82	2,45

Reproductive system disorders in mothers	1,23	1,38
Complications during the pregnancy with this girl	1,36	1,56

To obtain prognostic coefficients, the following parameters were sequentially calculated: the normalized intensive indicator (N), the intensive indicator per 100 girls (R), and the prognostic coefficient (X). The most significant risk factors are a combination of a history of infectious diseases with acute and chronic tonsillitis (weight index – relative risk indicator R=2.0), the presence of thyroid pathology during puberty (R=2.04), mental and physical strain (R=1.82), age at menarche (R=1.79), and socioeconomic and living conditions (R=1.67).

By calculating the sum of R (ΣR) for all factors (18.49) and determining the sum of the maximum and minimum values of the prognostic coefficients as follows:

ΣX min = 15,76 Σ R max = 25,0

The boundaries of the risk ranges (P_{min} and P_{max}) were established:

P_{min} = 0,85 P_{max} = 1,35

Risk boundaries: 0,85 – 1,35

it is possible to determine the risk ranges for the development of DP (Table 2).

Table 2.

Risk ranges for the development of delayed puberty in adolescent girls

Risk Range	Range Value	DP Grade	Prognosis
Low risk	0,85 – 1,0	I	Favorable, with timely detection and elimination of factors.
Medium risk	1,01 – 1,15	II	Requires increased attention and appropriate treatment.
High risk	1,16 – 1,35	III	Requires medical-genetic consultation and treatment by specialists.

Methodology for Using the Prognostic Table

* Obtain data regarding the specified factors from the examined adolescent girl;

* Calculate the sum of prognostic coefficients for all risk factors present in the subject (Σ Xn);

* Calculate the integrated risk indicator for the given subject $\Pr = \frac{\Sigma X}{\Sigma R}$

* Determine the risk range and risk group of the subject using the risk group table (Table 2) and define the observation strategy (management tactic).

For example: A 15-year-old girl presents with a body mass deficit (adjusted for age and height) and menarche at age 15. She has a history of chickenpox (varicella), mumps (epidemic parotitis), and chronic tonsillitis followed by a tonsillectomy. Over the last 3 years, she has suffered from chronic hepatitis or thyroid gland pathology. Social anamnesis: She lives in an urban area, at home; both parents have no harmful habits. She attends school and takes additional English classes. Family history: The mother had reproductive system disorders (underwent surgery for an ovarian cyst); there were no complications during the pregnancy with this child.

In accordance with her data, using the prognostic table (referring to Table 2), we identify the prognostic coefficients, sum them up, and calculate the integrated risk indicator:

$\Pr = \frac{22,12}{18,49} = 1,19;$

The risk of delayed puberty in this adolescent is "high," and the prognosis is unfavorable. A mandatory

consultation with a district pediatric gynecologist is required, accompanied by parental counseling regarding the risk factors and the degree of risk. The pediatric gynecologist must conduct a thorough examination of the adolescent. If necessary, she should be referred for consultation with a regional or republican-level pediatric gynecologist and undergo a medical-genetic examination. Recommendations for treatment and follow-up must be recorded in the adolescent's outpatient medical record. Timely visits to the pediatric gynecologist must be ensured based on the recommendations in the medical record, or more frequently if clinically indicated.

CONCLUSION

The criteria developed for predicting reproductive system disorders in girls are simple and accessible for application by primary healthcare personnel (pediatricians, family physicians, general practitioners, pediatric gynecologists, midwives, and visiting nurses) and require no special training. The application of prognostic tables will facilitate the screening of adolescent girls (aged 13–17 years) during annual preventive examinations at the General Practitioner (GP) level, allowing for their stratification into risk groups for Delayed Puberty (DP). Furthermore, it enables a differentiated and targeted approach to primary prevention by identifying leading risk factors. Such organization of work will enable the establishment of effective coordination with specialized pediatric gynecology services at the local level, ensuring the prevention and timely detection of potential abnormalities in the reproductive system of adolescent girls.

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