Anatomical and Morphological Features of the Pelvic Structure of Tall Female Students

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Abstract

The article presents the results of a study of identification of the characteristics of the bone of the pelvis at the female students of high growth. The aim of the article is the description and analysis of the identified morphological and anatomical and anthropological features of the pelvis of the girls. The methods of the study were pelviometry, anthropometry, method of indices, analysis and statistical processing of the results. The dimensions of the female pelvis, the basis of all professional activities of a midwife as an important subject of pregnancy and birth. Therefore, of particular interest is a comprehensive study of special values of morphological and anthropological indicators, the variability of shapes and size of the pelvis in young women, especially in youth and the first reproductive years, among which is dominated by a female students.

As a result of our research in the whole group we obtained the mean value of the index of pelvic bones – 40,53±0,84 cm, indicating a sufficient level of maturity and readiness. In the studied group of students is dominated by tall girl having indicators is not wide or normal and the narrow pelvis – 76,67%. Also noteworthy is the fact that almost every third girl are more or I-III degree of narrowing of the pelvis on the background of its morpho-anthropometric changes, which is quite common among modern girls. It is established that the external dimensions of the pelvis are in close correlation with other dimensions of a woman's body where leading role belongs to the length and body weight. The results of the study indicate that among students of high growth are dominated by those that are shoulder-width apart (35,50±0,86 cm) longer than the width of the pelvis (32,12±0,43 cm). This shows android and not gynecolgy type of construction of the torso of the body, which is not typical for girls.

The practical significance of the conducted research consists in the identification of certain violations of reproductive health among this group of students of high growth. It is established that in the future, having identified numerous changes in the structure and shape of the bony pelvis, most of them can have problems during pregnancy and childbirth. The results of the study indicate that among students with high growth are dominated by those that have a shoulder width greater than the width of the pelvis. This shows android and not genecide type of build of the trunk of the body, is not typical for girls. The absolute predominance of different options narrow basins indicates that among modern girls undergoing certain morphological changes in their bodies. Further research will focus on studying the peculiarities of the menstrual cycle in this group.

Keywords: Female Students; High Growth; Anthropometry; Morphological Features; Size of the Pelvis; Index Score

Abbreviations: ANP: Anatomically Narrow Pelvis; PRWI: Pelvic Relative Width Index; BMI: Body Mass Index; PI: Pelvic Index; PBI: Pelvic Bone Index; BMI: Body Mass Index; GDI: The Sexual/Gender Dimorphism Index; OMC: The Menstrual Cycle; PBI: Pelvic Bone Index; RPBWI: Relative Pelvic Bone Width Index SPI: Shoulder-Pelvic Index; SI: Solovyov Index; SPI: Shoulder-Pelvic Index; PW: Pelvic Width; SW: Shoulder Width; RSWI: Relative Shoulder Width Index; IRSB: Index Of Relative Shoulder Breadth; RMGI: Rorer Mass-Growth Index; BOI: Body Obesity Index.

Introduction

The accumulation of knowledge about the patterns of development of the female body is one of the urgent tasks of modern preventive and clinical medicine. The dimensions of the female pelvis are the basis of all professional activities of the obstetrician as an important object of gestation and childbirth [1]. Therefore, a comprehensive study of morphological values and anthropological indicators, variability of pelvic shapes and sizes in young women, especially in adolescence and the first reproductive age, among which the dominant place is occupied by female students, is of particular interest [2-4].

A study of the scientific literature reveals an insufficient number of works devoted to the study of individual anatomical variability of the female body at the age of 17-23 years, i.e. during the period of completion of growth in length, completion of the formation of morphological and psychological status, achievement of functional perfection of the reactions of various body systems, completion of the formation and ossification of the pelvis, the onset of puberty and, accordingly, the body's readiness to perform reproductive function [2]. Individual and age-specific features of the female pelvis are prognostic criteria for the choice of prenatal and labor tactics in obstetrics, as well as indicators of normal sexual development in adolescence and adulthood [1,5,6]. Changes in social conditions, a significant increase in psychoemotional stress and stressful situations, intensive sports activities for girls from an early age, as well as acceleration processes have led to a transformation in the frequency and structure of the anatomically narrow pelvis.

If at the beginning of the last century, the pelvis with a general uniformly narrowed and flat pelvis prevailed among narrow pelvises, in recent years the first place in frequency is occupied by a transverse narrowed pelvis and pelvises with a decrease in the straight size of the wide part of the pelvic cavity [4-7]. The existing standards of external pelvic dimensions, which include the assessment of acceleration and deceleration processes, have not been revised for several decades and adapted normative indicators for certain age groups have not been developed.

It has also been established that the external dimensions of the pelvis are in a fairly close correlation with other dimensions of the woman's body, where the leading role belongs to the length and weight of the body [3,8]. It is believed that in tall women, in addition to a normal pelvis, a wide pelvis is most common, with childbirth in which in most cases the outcome is favorable for the mother and fetus [3]. However, according to Puchko TK, 11.2% of women with anatomically narrow pelvis had a body length of 170 cm or more, and the frequency of anatomically narrow pelvis in "high-risk" pregnant women was 6.9±0.12% [3,4]. In tall women, there are no reliable markers of a narrow pelvis among the anthropometric measurements generally accepted in obstetrics [9,10].

We should also take into account the fact that acceleration processes have led to changes in the initial anthropometric data of modern women: body length, growth rate, and pelvic dimensions of an adult woman have changed (on average, the external dimensions of the pelvis increased by 1.2-1.8 cm, internal dimensions by 0.3-0.6 cm), and body length by 1.7 cm [3,4]. A wide pelvis, which occurs most often in tall women, is not considered pathology; its size exceeds the norm by an average of 2-3 cm. It is detected during a standard examination and pelvic bone pelvimetry [10]. In obstetrics, the pelvic dimensions of girls from the age of 18 are considered to be consistent with those of adult women [1-3,5]. Therefore, the relevance of studying the body parameters of girls in adolescence and the first reproductive age, especially the size of their bone pelvis, is quite obvious, since it is these girls who, in the future, will be entrusted with the responsible task of bearing and giving birth to a healthy, viable child [1,6,7,11].

Aim of the work

The purpose of the article is to identify anatomical, anthropological and morphological features of the bony pelvis of tall female students, to study and analyze a number of anthropometric indicators and special morphological indices related to the shape and size of the pelvis, based on the peculiarities of its structure.

Object, Material and Methods of Research

In the study, tall girls (n=30) were selected from 256 third- and fourth-year students of the Classical Private University by determining their body length. A pelvimetric examination of the students was conducted, in which 3 transverse dimensions were measured: inter-osteum, inter-crestal and inter-vertebral distances, as well as the straight dimension - the value of the external conjugate. In the case of detection of a particular form of pelvic narrowing, the variant of anatomically narrow pelvis (ANP) was determined

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by the form of its narrowing [5,6]. Anthropometric and pelvic examination was performed according to the generally accepted methodology [2,4]. The following anthropometric measurements were used: standing body length, body weight, body mass index (BMI), shoulder width, pelvic width, wrist circumference and Solovyov index.

The ratio of individual anthropometric features was evaluated in the form of a number of special morphological indices: pelvic relative width index [7,12], shoulder relative width index (shoulder RWI) [12-14]. Also, when assessing the peculiarities of the structure and function of the pelvis, morphological index values specific to this type of examination were used: pelvic index (PI), pelvic bone index (PBI) according to the method of Kovtyuk NI [1]. To determine the characteristics of the morphotype and somatotype of the students involved in the study, we used the definition of andromorphism indices, stenosis index [12,15,16] and sexual dimorphism index by Tanner J [17].

The morphometric indices were evaluated, which allowed us to judge the hormonal imbalance in the body of female students with increased body length, namely: the ratio of the length of the lower limb (L) to height (L/R), the ratio of the interacromial size (A) to the intertrochanteric (T) size of the pelvis (A/T), the ratio of the sum of the pelvic sizes to height ($\Sigma T/R$) [18-20]. The method of mathematical statistics was used in the processing of the obtained results, the reliability of differences was determined using Student's t-test. Statistical processing was performed using the Statistica 7.0 software package.

Results of the Study and Discussion

To conduct the study, we identified a group of tall female students (n=30) during a medical examination of first- and second-year university students. The female students who participated in the study belonged to two age groups: adolescence and early adulthood. The examined girls did not have significant differences in age (mean age was 21.05±0.38 years), but differed in length and body weight (p<0.05). When analyzing the results of anthropometric indicators in the group of tall students, the following indicators were obtained: the average height in the whole group was 173.13±0.68 cm. At the same time, 29 people (22.31%) of the total number of female students and 96.67% of the number of "tall" students were tall (170-179 cm). The average height in this group (n=29) was 175±1.32 cm. Very tall height (180-190 cm) was determined in 1 (0.77%) girl from the total number of all students and 3.33% of the number of "tall" students.

Body weight in the group (n=30) was 62.7±2.28 kg. The value of body mass index (BMI) was 20.90±0.72 kg/m². A more detailed examination of the values revealed that BMI less than 18.5 kg/m² (weight loss) was determined in 11 (36.67%) students. BMI values from 18.5 kg/m² to 24.9 kg/m² were found in 15 (30.00%) girls, which corresponds to normal BMI values [12,13,21]. 4 (13.33%) students have a BMI greater than 24.5 kg/m² (weight gain).

During the study, we also determined the index of sexual dimorphism (SDI) by Tanner J in tall girls [15-17] to determine their sexual somatotype. ISD allows to identify gender peculiarities of metabolic and hormonal status and to establish the correspondence of bone development to sex [17]. The following results were obtained: the average value of the index in the group was 80.00±2.46. The gynecomorphic type (less than 73.1 cm) was determined in 23 (76.67%) students. The mesomorphic type (from 73.1 to 82.1 cm) was determined in 1 (3.33%) student. Andromorphic type (more than 82.1 cm) of sexual somatotype was determined in 6 girls (20.00%).

We also determined the stenosis index to determine the somatotype (2, 94; 19, 46; 20, 138). The value of the index in the group was 4.95±0.10, which corresponds to normostenia [14,15]. Asthenic somatotype (more than 5.15) was determined in 12 (40.00%) students, normosthenic somatotype (from 4.81 to 5.15) - in 9 (30.00%) students, and hypersthenic somatotype (less than 4.8) was also determined in 9 (30.00%) students with high growth [2,14].

Additionally, the andromorphia index was determined, which indicates certain sexual characteristics of the metabolic and hormonal status and allows to distinguish: androgyny (over 73.5), orthogynoid (balanced) from 67.5 to 73.5 and hypergynoid (less than 67.5) types of constitution [12,15]. The following results were obtained: the average value of the andromorphism index in the group was 74.19±2.55, which corresponds to the android type. It was determined in 11 (36.67%) students, orthogynoid type in 10 (33.33%), hypergynoid type - in 9 (30.00%) female students.

The values of wrist circumference (14-16 cm) and Solovyov index (SI), which is normally equal to 1.4-1.6 cm [2,7,12] have the following values in the group: less than 1.4 SI was determined in 2 (6.67%) students, SI values from 1.4 to 1.6 have 27 (90.00%) students, more than 1.6 cm - 1 student, or 3.33%. The average value of IC is 1.48±0.2 cm.

Comparative values of the obtained indicators of shoulder and pelvic width and related values and special indices are shown. The values of shoulder and pelvic width and related morphological indexes are as follows:
- ➢ **SW** - shoulder width – 35,50±0,86 cm;
- ➢ **PW** - pelvic width – 32,12±0,43 cm;
- ➢ **RSWI** - Relative Shoulder Width Index – 20, 37±0,49 cm;

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➢ **RPBWI** - relative pelvic bone width index (PBWI) – 15,42±0,26 cm;

➢ **SPI** - shoulder-pelvic index - 75,54±1,69 cm

The shoulder width (SW) in female students was measured as an important element of an anthropometric examination and in the calculation of a number of special morphological indices [8,16,21]. In the whole group, this indicator was 35.50±0.86 cm. The width of the pelvis (bitrochanteric diameter) was determined as a result of pelviometry by one of the transverse dimensions of the large pelvis - d. trochanterica [2,5,11]. In the whole group (n=30), it was 32.12±0.43 cm. It has been reliably determined that in this group of tall students the width of the shoulders (35.50±0.86 cm) is greater than the width of the pelvis (32.12±0.43 cm) (p<0.05). This indicates an android rather than gynecoid type of trunk structure, which is not typical for girls in general and in particular for this age group [8].

We also determined the values of the shoulder-pelvic index (PPI) according to the method proposed by Khrisanfova EN (6, 11; 15, 64). In the whole group, this index was 75.54±1.69 cm, which corresponds to a rectangular torso shape [8]. Trapezoidal body shape (WHI up to 69.9 cm) is observed in 7 (23.33%) students, medium (WHI 70-74.9 cm) - in 5 (16.67%), and rectangular body shape (75 cm and more) was recorded in 18 (60.0%) students with short stature [8]. The data obtained allow us to speak again about the ratio of WH to WH, which is not typical for women. The predominance of WH over WH is characteristic of andromorphic, not gynecomorphic body type [2,8].

Additionally, we determined such an informative morphological indicator as the index of relative shoulder breadth (IRSB), or morphology index, according to the method of Kozlov AI and Nikitiuk BA [2,4,11]. The average value of the index in the study group is 20.37±0.49 cm, which corresponds to the mesomorphic type. Dolichomorphic type (value less than 19.1 cm) was determined in 11 (36.67%) students. The mesomorphic type (19.1-21.7 cm) was recorded in 12 (40.00%) students, the brachymorphic type (more than 21.7 cm) - in 7 (23.33%) tall students.

The values of the relative pelvic width index (RPWI) in the whole group amounted to 15.42±0.26 cm, which corresponds to the values of stenopyelia (narrow pelvis) [2,8,11]. However, a more detailed examination revealed that the values of the IUI corresponding to a narrow pelvis (up to 15.9 cm) were determined in 23 (76.67%) students. The values of the WCI corresponding to normal values (from 16.0 to 17.9 cm) were determined in 5 (16.67%) students, the values corresponding to a wide pelvis were found in 2 (6.67%) students. That is, the study group of tall students is dominated by girls with indicators of not wide or normal, but narrow pelvis - 76.67%.

External pelvic dimensions are also taken into account when assessing the state of physical development in the female population [1,2,10]. In the group of examined female students they have the following values: interosseous size (*d. spinarum*) - 24.07±0.48 cm, intercrestal size (*d. cristarum*) - 26.50±0.43 cm, intertrochanteric size (*d. trochantreica*) - 32.12±0.43 cm, straight external size (*c. externa*) - 19.25±0.25 cm, true conjugate size (*c. vera*) - 11.32±0.59 cm. The results provide diverse information: on the one hand, the data obtained indicate the presence in this group of female students (n=30) with increased body length of signs of anatomically narrow pelvis (ANP) [6,7,9,11]. This is indicated by a decrease of 1.0-1.5 cm in two straight (*d. spinarum* and *d. cristarum*) dimensions and one straight (*c. externa*) dimension. On the other hand, such an important indicators as the true conjugate (*c. vera*), or the straight size of the entrance to the pelvis, is more important than the officially defined physiological value for a normal pelvis (11 cm) [8-10], namely, 11.32±0.59 cm. Varieties of pathological changes in the pelvis, depending on the obtained values of the true conjugate (*c. vera*) - changes in the bone pelvis depending on the values of the true conjugate.

➢ Normal dimensions of the true conjugate (including "mixed" pelvic shape – 16 female students (53,33%);

➢ First degree of pelvic narrowing – 5 female students (16,67%);

➢ Second degree of pelvic contraction (pelvic narrowing) – 4 female students (13, 33%);

➢ Third degree of pelvic narrowing – 1 female students – 3? 33%;

➢ Size of the true conjugate (*c. vera*), more than 11 cm – 4 students (13, 33%).

Normal values of the direct size of the entrance to the pelvis (*c. vera*) dominate, but with a progressive number of "erased" or "mixed" pelvic forms (11 cm) in recent years [1,5,11]. Also noteworthy is the fact that almost every third girl has I-III degree of pelvic narrowing against the background of its morpho-anthropometric changes, which is quite common among modern girls [4,6,9,10]. When determining such an important morphological indicator as the pelvic index (PI), which is used for anatomical and morphological characteristics of the structure and structure of the bone pelvis, the following values were obtained: in the entire group of female students (n=30), its value is 101.6±8.16 cm, which corresponds to normal values [6,10,11]. When analyzing individual values, it was recorded that 14 (46.67%) students had a value less than 100 cm, and 16 (53.33%) students had a value more than 100 cm. This indicates that almost half of the surveyed female students 14 (46.67%) have a narrow pelvis [6,10.11]. In addition, we determined the ratio of the sum of the four external pelvic dimensions

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to body length (ΣT/P), which is used in clinical practice to characterize androgen-dependent effects in the female body [19]. This method is actively used in domestic researches of the state of reproductive health of girls-athletes. We have obtained the following results: in the whole group the value of ΣT/R was 59,1±0,01 cm. This is lower than the normative «corridor» of the determined values of 60.4-62.8 cm, which indicates the presence of hormonal imbalance in girls and the development of morphological signs of primary estrogen deficiency in most of them - 16 (53.33%) [10,18]. The value of the ΣT/P index within the permissible norm [18,20] was recorded in 7 (23.33%) and a higher value of ΣT/P was also recorded in 7 (23.33%) students.

The ratio of the interacromial (A) size to the intertrochanteric (T) size of the pelvis (A/T) in the entire study group was 1.03±0.06 cm, which is also less than the normal values (1.15-1.23), indicating the presence of hormonal imbalance in female students and the development of morphological signs of primary estrogen deficiency [18,20] in most of them - 18 (60.00%). In 9 (30.00%) students, the obtained index corresponded to the norm, and in 3 (10.00%) it exceeded it, which may be a sign of hyperandrogenism [18]. To determine the degree of "maturity" and the stage of ossification of the pelvic bones, we used a new author's index - the pelvic bone index (PBI), proposed by Kovtyuk NI [1]. According to her calculations, in order to detect deviations in the formation of pelvic bones, we calculate the PCI as an integral indicator of pelvic bone formation in girls of adolescent and reproductive age [1]. As a result of our study in the whole group, we obtained an average value of the PCI - 40.53±0.84 cm. The obtained values of the pelvic bone index (PBI) in tall female students:

- Pelvic bone index (PBI) > 50 cm – 2 female students – 6,67%;
- Pelvic bone index from 30 to 40 cm – 10 female students – 33, 33%;
- Pelvic bone index from 40 to 50 cm – 18 female students – 60, 0.

In all 100% of female students, this indicator was both within the normal range - 62 (47.69%) and above it 67 (51.54%) Among the PBI indicators, the value of which exceeds the upper limit of the norm (40 cm), it was found that the PBI value from 40 to 50 cm was in 18 (60.8%), from 50 to 60 in 2 (6.67%). In our opinion, the values of PBI more than 40 cm in 20 girls (66.67%) indirectly indicate the phenomena of individual hyperestrogenism, which is expressed in the enhanced processes of ossification of the pelvic bones and the completion of their final age formation [1]. After determining the pelvic parameters of the 4 external pelvic dimensions and evaluating them, the main pathological variants of the bony pelvis were identified. Pathological types of pelvis in a group of tall female students/Pathological types

of pelvis in a group of tall female students:
- Transverse pelvic constriction/ Transversely narrowed pelvis – 17 female students – 56,67%;
- "mixed" shape of the pelvis – 15 female students 50,00%;
- Wide/broad pelvis – 4 female students – 13,33%;
- Simple flat/ flat pelvis – 1 female students – 3, 33%.

Among them dominate: transverse-narrowed pelvis and "erased" or "mixed" pelvic forms, which are characterized by a decrease in one or two dimensions of the pelvic cavity [7,11]. In the group of tall students, there was not a single girl with normal external pelvic dimensions. The study determined the dominance of a narrow pelvis, with its various types and forms. Only 4 (13.33%) had pelvic dimensions that corresponded to the values of a wide pelvis.

Conclusion

The results of the study indicate that among tall students, those with shoulder width (35.50±0.86 cm) greater than pelvic width (32.12±0.43 cm) dominate. This indicates an android rather than gynecoid type of body structure, which is not typical for girls. The values of all index values associated with these indicators confirm the dominance of androgenic accents in the formation of morphological and anthropometric indicators in this group of students. The absolute predominance of various variants of narrow pelvises and the complete absence of girls with normal pelvic indicators proves that among modern girls and in the majority of the modern youth population, certain morphological changes occur in their bodies.

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