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FEATURES OF MORPHOMETRIC PARAMETERS OF RENAL CALYCES IN ADOLESCENTS AND YOUNG PEOPLE

Abstract. *Analysis of features of morphometric parameters of the volume of renal calyces in adolescence and young people makes it possible to conclude that there are three groups of renal calyces. The upper renal calyx has the largest volume (VS = 3907.9 ± 476.4 mm3), which is significantly different from the volume of the lower renal calyx (VI = 1927.9 ± 396.8 mm3) (p <0.05). Volumes of anterior (A1, A2, A3) and posterior (P1, P2, P3) renal calyces significantly (p <0.05) differ from the volume of the upper calyx. In this age group, from the moment of birth, the volume of the anterior middle renal calyx (A2) significantly (p <0.05) exceeds the volume of the anterior lower one (A1), and the volume of the posterior middle renal calyx (P2) exceeds the volume of the posterior upper (P3) and posterior inferior (P1) renal calyces. The specific gravity of the volumes of individual calyces in the total volume of the pyelocalyceal complex (PCC) in descending order: the upper renal calyx - 33.9±2.4%, the lower renal calyx - 16.1±2.1%, the middle posterior renal calyx - 13.9±2.5%, the middle anterior renal calyx - 13.2±1.1%. The correlation analysis between the volume of individual calyces and the total volume of PCC in adolescents and young people revealed a direct medium-strength relationship between the total volume of the PCC and the volume of the posterior lower renal calyx (VP1; rRC = +0.63) and the inverse medium-strength correlation with volume the posterior middle (VP2; rRC = -0.56) and the posterior upper renal calyces (VP1; rRC = -0.52).*

Key words: *kidney, pyelocalyceal complex, renal calyces.*

Introduction. Anatomy of the kidney continues to be the subject of close study in connection with the use of organ-preserving operations on the kidneys. In recent years, various aspects of the anatomy of the pyelocalyceal complex [1-2] and renal calyces of mature and elderly people have been intensively studied [3]. However, a number of questions of the anatomy of the renal calyces of children, as well as of adolescents and young people, have not been studied to date. We described the morphometric characteristics of renal calyces of children of different age groups [4-5].

Objective. To study the morphometric characteristics of the renal calyces of adolescents and young people: the diameter of the vault of the renal calyx (d_{RC}), the height of the renal calyx (h_{RC}), the diameter of the cervix of renal calyx (c_{RC}), the volume of the renal calyx (V_{RC}).

Materials and methods. A total of 20 isolated organs of this age group without congenital anomalies or pathology of uronephrosis were studied. According to the classification of L.K. Semenova, taking into account the periods of a child's life, according to N.P. Gundobin, this group included males aged 13-21 and females aged 12-20. The mean age of the examinees was 14.8±2.3 years.

The following basic methods of anatomical research were used in this study:

- making casts of the pyelocalyceal complex;
- intrarenal contrast;
- organometry of kidneys, pyelocalyceal complex and renal calyces with 41 parameters.

The obtained morphometric data were subjected to statistical processing by variational methods, calculation of correlation, linear regression, information-entropy analysis, and others.

Mathematical modeling of the renal calyces and pyelocalyceal complex was carried out according to a specially developed computer application program based on the method of least squares (simulation and morphogramming).

Using these methodological approaches, morphochronograms of the renal calyces and

mathematical dependences were obtained.

Results and discussion. In adolescents and young people, the upper renal calyx (S) is a constantly present anatomical formation of the pyelocalyceal complex (G_S=0) characterized by the following linear dimensions: d_S = 16.2±1.1 mm, h_S = 11.6±1.3 mm, c_S = 8.5±0.9 mm. Its conical shape also retains with the predominance of the diameter of the vault of the calyx over the diameter of its anastom with the greatest height of the calyx. The total volume of this renal calyx (V_S) in adolescents and young people varies between 3088.2-5222.4 mm^3 with V_S = 3907.9±476.4 mm^3.

The lower renal calyx (I) is the anatomical formation present in all studied pyelocalyceal complexes (G_1=0) and is characterized by the following linear dimensions: d_I = 10.9±1.2 mm, h_I = 9.4±1.0, c_I = 6.5±0.7 mm. In comparison with the younger age groups, the individual variability of the diameter of the arch of this calyx (d_I = 7.0-13.0 mm) is less, there is no difference (p> 0.05) between its height and the diameter of its arch, which does not allow us to classify the shape This cup is conical, although the cup has a sufficiently larger height than the anterior or posterior renal calyces. The lower renal calyx in adolescents and young people has a wide, unstable anastom size (c_I = 5.0 ÷ 8.0 mm); its volume (V_I) does not reach significant differences from that in children of younger age groups and varies significantly ($V_I$min/max = 872.1-2700.4 mm^3) with V_I = 1927.3±396.8 mm^3.

Anterior renal calyces (A1, A2, A3) in adolescents and young people are characterized by considerable heterogeneity. Thus, most often there is no anterior upper renal calyx (G_{A3} = 0.350), less often anterior lower (G_{A1} = 0.050) and anterior middle (G_{A2} = 0.050) renaal calyces are absent. According to the linear dimensions and the total volume, these renal calyces in adolescence and young people do not differ (p>0.05). However, (in contrast to children 8-11 years old), the volume of anterior middle renal calyx is the largest: V_{A2} = 1553.7 ± 252.7 mm^3.

Posterior renal calyces (P1, P2, P3) in adolescents and young people are more heterogeneous than the anterior ones, which is manifested by the frequent absence of the posterior upper (G_{F3} = 0.300) and posterior lower renal calyces (G_{F1} = 0.280), less often posterior middle (G_{P2} = 0.050) renal calyx is absent. The diameter of the arch of the renal calyces of this group is subject to fluctuations (d_{P1-3} = 5,0-10,0 mm), the height of the renal calyces does not exceed the diameter of the arch (h_{P1-3} = 5,0-12,0 mm), and the size of the anastom does not differ from that in the anterior renal calyces. This pattern, from the moment of birth, is preserved in childhood and adolescence.

Thus, in adolescents and young people, the group of "large" renal calyces includes: upper (S) and lower (I) ones. The second group is represented by medium renal calyces (anterior middle (A2) and posterior middle (P2)). The third group includes upper and lower renal calyces among which middle posterior (V_{P2}) renal calyx prevails. It is necessary to emphasize the reliable differences between the upper and lower renal calyces, which preserves the three-level classification of renal calyces by volume.

The specific gravity of the volumes of individual calyces in the total volume of PCC is the following (in decreasing order): the upper renal calyx is 33.9±2.4%, the lower renal calyx is 16.1±2.1%, the middle renal calyces are 13.9 ± 2.5% - posterior and - 13.2 ± 1.1% - anterior. The correlation analysis between the volume of individual calyces and the total volume of PCC in adolescents and young people revealed a direct medium-strength relationship between the total volume of the PCC and the volume of the posterior lower renal calyx (V_{P1}; r_{RC} = + 0.63) and the inverse medium-strength correlation with volume of the posterior middle (V_{P2}; r_{RC} = -0.56) and the posterior upper renal calyces (V_{P1}; r_{RC} = -0.52).

The most distinctive feature of the anatomy of the pyelocalyceal complex in adolescents and young people is progressive growth in the volume of the posterior and anterior renal calyces (their transition to the "large" class), which supports the ongoing evolution of the kidney and the PCC (anterior and posterior remal calyces are functiolly differentiated on the first stage (in 1-3 years of age), the lower and lower posterior renal calyces are enlarged on the second stage increases in size, middle renal calyces are differentiated to separated group on the third stage).

Conclusions. Morphometric analysis of the

volume of the renal calyces in adolescents and young people allows us to conclude that there are three groups of renal calyces classified according to volume. Thus, upper renal calyx has the largest volume (VS = 3907.9±476.4 mm3) which significantly differs from the volume of the lower renal calyx (VI = 1927.9 ± 396.8 mm3) ($p < 0.05$). The volumes of the anterior (A1, A2, A3) and posterior (P1, P2, P3) renal calyces significantly ($p < 0.05$) differ from the volume of the upper calyx. In the analyzed age group, for the first time (from the moment of birth), the volume of the anterior middle renal calyces (A2) significantly ($p<0.05$) prevails over the volume of the anterior lower one(A1) and the volume of the posterior middle renal calyx (P2) prevailes over volumes of the posterior upper (P3) and posterior lower (P1) renal calyces.

Actually, all of the above is nothing more than a generalized model of the morphometric dynamics of changes of pyelocalyceal complex in children, adolescents and young people investigated in the present study, the use of which presents new opportunities for descriptive (qualitative) anatomy and for clinical (quantitative) anatomy the of human pyelocalyceal complex.

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