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CHANGES IN MORPHOMETRIC PARAMETERS OF HUMAN RENAL CALYCES DEPENDING ON AGE

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For today we have new data about anatomy of human renal calyces [1]. However, the use of noninvasive diagnostics (ultrasound, MRI and CT scan) in modern nephrourology, as well as an introduction to the surgical practice of organ saving operations (percutaneous puncture of renal calyces, extracorporeal lithotripsy), require the most detailed study of the initial department of extrarenal urinary tract [2, 3], namely, renal calyces and their age characteristics.

Material and methods. The material of the study included 175 human kidneys (88 of men and 87 of women), obtained from corpses of mature and elderly people who lived in Ukraine in Kharkiv and Kharkiv region and died as a result of accidents or died of diseases not associated with renal disease. We obtained pyelocalyceal complexes with corrosive method and measured their linear parameters: diameter of calyceal arch (d_c), calyceal height (h_c), and diameter of calyceal cervix (c_c) and performed statistical analysis of data by methods of linear regression, informational-entropic analysis variational method, etc.

Results. Diameters of calyceal arches (d_c) are variable in different age groups (table 1) and vary between 11.5 ± 5.7 mm (upper renal calyx) and 5.6 ± 1.3 mm (lower renal calyx). Difference in average sizes between the biggest (upper) and the smallest (lower) renal calyces is highly significant ($t > 3$). Arches of all renal calyces don't significantly change in different age groups (except lower one, $t > 2$)).

Table 1

Diameters of calyceal arches of mature and elderly humans (in age aspect)

Name and designation of renal calyces		Number of organs	Age groups	$d_c \pm \delta$ (mm)
Upper	S	7	< 29 years	9.9 ± 2.9
		28	30–39 years	11.4 ± 3.9
$t_{min-max} = 1.8$		42	40–49 years	11.5 ± 5.7
		57	50–59 years	11.5 ± 5.0
		41	>60 years	11.0 ± 4.0
Upper anterior	A_3	7	<29 years	7.0 ± 1.1
		28	30–39 years	7.0 ± 2.8
$t_{min-max} = 1.1$		42	40–49 years	7.1 ± 1.8
		57	50–59 years	6.7 ± 2.4

Name and designation of renal calyces		Number of organs	Age groups	$d_c \pm \delta$ (mm)
		41	>60 years	6.7 ± 1.9
Upper middle	A_2	7	<29 years	7.2 ± 1.5
		28	30–39 years	7.5 ± 1.9
$t_{min-max}$ = 0.9		42	40–49 years	7.1 ± 1.8
		57	50–59 years	7.6 ± 2.1
		41	>60 years	7.4 ± 2.2
Lower anterior	A_1	7	<29 years	7.8 ± 2.6
		28	30–39 years	7.8 ± 3.3
$t_{min-max}$ = 1.3		42	40–49 years	7.4 ± 1.9
		57	50–59 years	7.1 ± 2.0
		41	>60 years	6.9 ± 2.0
Upper posterior	P_3	7	<29 years	8.9 ± 2.7
		28	30–39 years	8.0 ± 3.3
$t_{min-max}$ = 1.1		42	40–49 years	8.5 ± 3.2
		57	50–59 years	8.9 ± 2.9
		41	>60 years	7.8 ± 2.7
Middle posterior	P_2	7	<29 years	9.0 ± 3.0
		28	30–39 years	8.4 ± 3.5
$t_{min-max}$ = 1.7		42	40–49 years	8.2 ± 2.1
		57	50–59 years	7.7 ± 2.0
		41	>60 years	7.2 ± 2.0
Lower posterior	P_1	7	<29 years	8.2 ± 3.9
		28	30–39 years	7.3 ± 2.3
$t_{min-max}$ = 1.6		42	40–49 years	7.0 ± 2.1
		57	50–59 years	7.3 ± 2.4
		41	>60 years	7.2 ± 1.9
Lower	I	7	<29 years	6.4 ± 1.3
		28	30–39 years	8.9 ± 3.9
$t_{min-max}$ = 2.3		42	40–49 years	7.2 ± 2.2
		57	50–59 years	7.2 ± 1.7
		41	>60 years	7.2 ± 1.9
d_c — average diameter of calyceal arch; δ — standard deviation				

Height of renal calyces h_c (table 2) significantly ($t > 2$) changes in different age groups: S — decreases by 2.5–3 times, P_2 — decreases by 1.5–1.7, I — increases by 2 times. Height of other renal calycesA_1, A_2, A_3, P_3, P_1) doesn't significantly change in different age groups. Upper renal calyx has maximal number of variants of height individual changes, especially in age 57.3 ± 3.0 years.

Table 2

Height of calyces of mature and elderly humans (in age aspect)

Name and designation of renal calyces		Number of organs	Age groups	$h_c \pm \delta$ (mm)
Upper	S	7	<29 years	32.8 ± 5.1
		28	30–39 years	17.4 ± 9.1

Name and designation of renal calyces		Number of organs	Age groups	$h_c \pm \delta$ (mm)
$t_{min-max}$ = 1,8		42	40–49 years	12.7 ± 7.9
		57	50–59 years	14.4 ± 9.5
		41	>60 years	12.9 ± 6.4
Upper anterior	A_3	7	<29 years	7.1 ± 2.3
		28	30–39 years	6.7 ± 3.3
t_{min-ma} = 1,1		42	40–49 years	7.0 ± 2.8
		57	50–59 years	7.4 ± 3.3
		41	>60 years	7.7 ± 2.9
Upper middle	A_2	7	<29 years	11.7 ± 2.6
		28	30–39 years	10.0 ± 4.8
$t_{min-max}$ = 0,9		42	40–49 years	9.9 ± 4.7
		57	50–59 years	11.5 ± 5.6
		41	>60 years	11.2 ± 5.4
Lower anterior	A_1	7	<29 years	10.0 ± 4.0
		28	30–39 years	7.8 ± 3.2
$t_{min-max}$ = 1,3		42	40–49 years	8.9 ± 4.8
		57	50–59 years	9.8 ± 4.9
		41	>60 years	9.2 ± 4.4
Upper posterior	P_3	7	<29 years	11.4 ± 5.6
		28	30–39 years	8.7 ± 4.8
$t_{min-max}$ = 1,1		42	40–49 years	8.3 ± 4.3
		57	50–59 years	8.5 ± 4.8
		41	>60 years	8.4 ± 3.8
Middle posterior	P_2	7	<29 years	17.0 ± 5.8
		28	30–39 years	11.7 ± 5.4
$t_{min-max}$ = 1,7		42	40–49 years	9.8 ± 4.5
		57	50–59 years	10.2 ± 4.4
		41	>60 years	10.4 ± 5.4
Lower posterior	P_1	7	<29 years	6.0 ± 0.9
		28	30–39 years	7.3 ± 4.4
$t_{min-max}$ = 1,6		42	40–49 years	6.6 ± 3.0
		57	50–59 years	6.0 ± 2.5
		41	>60 years	8.7 ± 4.2
Lower	I	7	<29 years	5.1 ± 1.6
		28	30–39 years	10.2 ± 3.1
$t_{min-max}$ = 2,3		42	40–49 years	9.1 ± 5.4
		57	50–59 years	8.0 ± 3.9
		41	>60 years	8.6 ± 4.3
$d_{пч}$ — average height of human calyx; δ — standard deviation				

The range of values of calyceal cervix diameter c_c (table 3) in different age groups doesn't differ significantly and is within 4.6 ± 7.9 mm. This fact demonstrates sufficiently stable morphometric value of index (both in types of renal calyces and in age aspect).

Table 3

Diameter of calyceal cervix of mature and elderly humans (in age aspect)

Name and designation of renal calyces		Number of organs	Age groups	$c_{пч}$±δ (mm)
Upper	S	7	<29 years	7.0 ± 2.6
		28	30–39 years	6.7 ± 1.7
$t_{min-max}$ = 1.8		42	40–49 years	7.9 ± 2.2
		57	50–59 years	7.3 ± 2.6
		41	>60 years	7.0 ± 2.3
Upper anterior	A_3	7	<29 years	5.1 ± 1.4
		28	30–39 years	5.3 ± 1.4
$t_{min-max}$ = 1.1		42	40–49 years	5.3 ± 1.4
		57	50–59 years	5.0 ± 1.6
		41	>60 years	4.2 ± 1.7
Upper middle	A_2	7	<29 years	4.8 ± 0.8
		28	30–39 years	5.2 ± 1.6
$t_{min-max}$ = 0.9		42	40–49 years	5.0 ± 1.6
		57	50–59 years	4.5 ± 1.6
		41	>60 years	4.9 ± 1.8
Lower anterior	A_1	7	<29 years	4.5 ± 1.5
		28	30–39 years	5.2 ± 2.2
$t_{min-max}$ = 1.3		42	40–49 years	4.6 ± 1.5
		57	50–59 years	4.9 ± 1.9
		41	>60 years	4.5 ± 1.8
Upper posterior	P_3	7	<29 years	6.7 ± 2.5
		28	30–39 years	5.9 ± 1.9
$t_{min-max}$ = 1.1		42	40–49 years	5.7 ± 2.0
		57	50–59 years	6.1 ± 2.1
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Middle posterior	P_2	7	<29 years	6.0 ± 2.1
		28	30–39 years	4.9 ± 1.9
$t_{min-max}$ = 1.7		42	40–49 years	5.5 ± 2.2
		57	50–59 years	5.2 ± 1.8
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Lower posterior	P_1	7	<29 years	5.4 ± 0.7
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$t_{min-max}$ = 2.3		42	40–49 years	4.9 ± 1.7
		57	50–59 years	5.3 ± 1.8
		41	>60 years	5.3 ± 2.6
$c_{пч}$ — average diameter of calyceal cervix; δ — standard deviation				

Conclusion. The resulting morphological information about human renal calyces in different age groups can be used to improve the diagnosis (ultrasound, CT and MRI) and surgical interventions on the kidney (extracorporeal lithotripsy).

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