

ORGANOMETRIC INDICATORS OF RAT KIDNEY MORPHOGENESIS IN THE AGE ASPECT

I.S. Khamroev¹, A.S. Ilyasov², N.E. Tukhsanova³

ANNOTATION

The article analyzes the macro anatomical parameters of the kidneys in early postnatal ontogenesis. Possible mechanism discussed changes in the organometric parameters of the kidneys in the age aspect. It was revealed that by the age of 12 months, the growth rate of the weight of the kidneys increases by 12.1 times and its length by 5.1 times.

The growth rate of organometric indicators of the kidneys by 21 days of age about 16 days of age increases by 19.0%, the thickness of the organ by 31.0%, the width of the kidneys to the levels of the upper pole by 8.0%, the distance between the kidneys to the levels of the upper pole by 21, 0%. In our opinion, this is due to the transition of rats to definitive nutrition. The shape of rat kidneys in early postnatal ontogenesis changes from the neonatal period, and by 6 days of age, it acquires a lenticular shape, by 16 and 21 days of age it acquires the shape of beans.

According to ultrasound examination, the capacity of the kidneys in the abdominal cavity by the age of 12 months increases 12.9 times compared with the neonatal period.

Keywords: kidney, rat, organometric parameters, morphogenesis.

INTRODUCTION

It is known that the kidneys are one of the organs that regulate the constancy of the internal environment of the body. They play an important role in the detoxification of the body, are actively involved in their metabolism and excretion from the body. In most cases, the excretion of toxic substances and their decay products is carried out by the kidneys through filtration, secretion, and excretion.

The study of changes in the development of the kidney, which plays a leading role in ensuring the excretory function of the body, is a necessary organ. In it, the action of toxic substances is the result of the own toxicity of a harmful substance and its decay products or the receipt of exorbitant concentrations and contacts in the kidneys [4].

The scientific literature discusses in detail the morphology of the small intestine [8], liver [7], rectum [3], and the kidneys of animals and humans, and issues related to the structure of the kidneys of rats is an important, urgent task for urologists and nephrologists.

The purpose of the work:

The research aims to study the patterns of growth and development of the kidneys of rats in the period of early postnatal ontogenesis.

MATERIALS AND METHODS

The material of the study was white outbred rats in the amount of 71 distinct at different times

of early postnatal ontogenesis. Rats were slaughtered at the age of 1, 6, 11, 16, and 21-days of postnatal development under ether anesthesia. After opening the abdominal cavity, the weight of the kidneys was studied, as well as the organometric indicators of the length, thickness, and width of the kidneys. We studied the shape of the kidneys in the age periods of postnatal development.

RESULTS AND DISCUSSION

Rat kidneys are smooth bean-shaped formations, red-brown in color. The kidneys are located in the lumbar region, at the level of the twelfth thoracic - second lumbar segments. The cranial and caudal edges of the organ are blunted. On the kidney, a convex lateral and somewhat concave medial edge is distinguished. The kidney is covered with a dense fibrous connective tissue membrane.

The weight of a newborn rat is on average 5.09 ± 0.03 g. In a 6 day old rat, the average weight is 8.07 ± 0.3 g. On the 11th day of development, the rat weighs an average of 17.5 ± 0.3 g. The weight of a 16-day old rat averaged 23.9 ± 0.45 g. By the 21st day of development, the average weight of the rat is 38.9 ± 0.8 g.

In newborn rat pups, the average weight of the kidneys is 0.03 ± 0.0004 g, the coefficient of the organ is on average 0.64 ± 0.02 g, in a 6-day-old rat, the weight of the organ is on average 0.04 ± 0.03 g, the coefficient of the

organ is on average -0.46 ± 0.01 gr. By the 11th day of life, the weight of the kidneys is 0.04 ± 0.0003 g, the coefficient of the organ is on average 0.24 ± 0.006 g. on average -0.20 ± 0.004 gr. On the 21st day of development, the weight of the kidneys is on average 06 ± 0.0009 g, and the coefficient of the organ is on average 0.15 ± 0.003 g. Table 1 shows rat and kidney weights with organ coefficient scores.

The length of the kidneys in a newborn rat is on average 1.51 ± 0.08 , at the age of 6 days the length of the kidneys is on average 2.58 ± 0.02 , at

11 days the average is 2.98 ± 0.03 , the length of the kidneys in a 16-day old rat, on average, 3.72 ± 0.02 ; at 21 days, the average length of the kidneys was 4.14 ± 0.03 .

The thickness of the kidneys in a newborn rat is on average 0.25 ± 0.01 , at 6 days the thickness of the kidneys is on average 0.35 ± 0.01 , at 11 days the average is 0.45 ± 0.01 , the thickness of the kidneys is 16 day-old rats averaged 0.61 ± 0.02 , at 21 days the thickness of the kidneys averaged -0.89 ± 0.02 .

Morphometric indicators of weight and organ changes in rats in early postnatal ontogenesis

Table 1

Age (days)	The number of rats	Kidney		
		Rat's weight	Organ's weight	Organ's coefficient
New born	15	4,8 - 5,2	0,03- 0,035	0,53 - 0,73
6 days	13	6,4 - 9,8	0,035- 0,38	0,39 - 0,55
11 days	14	15,1 - 19,6	0,04 - 0,044	0,21 - 0,28
16 days	15	20,1 - 25,9	0,045 - 0,052	0,18 - 0,23
21 days	14	35,2 - 44,9	0,054 - 0,065	0,14 - 0,18

In a newborn rat, the width of the kidneys in the upper pole is on average 2.17 ± 0.03 mm, at the levels of the gate - 2.17 ± 0.03 mm, at the levels of the lower pole - 2.17 ± 0.03 mm, On the 6th day of development of rats the width of the kidneys in the upper pole is on average - 2.26 ± 0.03 mm, at the gates of the kidneys - 2.31 ± 0.03 mm, in the lower pole - 2.26 ± 0.03 mm, By the 11th day of age of the rat, the width of the kidneys in the upper pole is on average - 2.44 ± 0.03 mm, at the gates of the kidneys - 2.36 ± 0.03 mm, in the lower pole - 2.30 ± 0.03 mm. - 2.63 ± 0.03 mm, at the gate - 2.53 ± 0.03 mm, in the lower pole - 2.44 ± 0.03 mm, By the 21st day of the rat's life, the width of the kidneys in the upper pole is on average - 2.85 ± 0.02 mm, at the gate - 2.56 ± 0.02 mm, in the lower pole - 2.46 ± 0.04 mm.

Our data correspond to the organometric parameters of rat kidneys according to L.M. Kurzina (2012), where he found a proportional

Organometric parameters of rat kidney parameters in early postnatal ontogenesis

Table 2

Age (days)	The number of rats	Kidney		Width (mm)		
		Length	Thickness	Top pole	At the gate	Lower pole

increase in the size of the kidneys from youthful to senile age.

The distance between the upper poles of the kidneys in newborn rat pups is on average 0.29 ± 0.0015 μ m, the lower poles 0.32 ± 0.004 μ m. In 6 day old rats, the distance between the upper poles of the kidneys is on average 0.30 ± 0.0017 μ m, the lower poles - 0.37 ± 0.003 μ m. The distance between the upper poles of the kidneys in 11-day old rat pups was on average 0.34 ± 0.003 μ m, the lower poles - 0.47 ± 0.01 μ m. At 16 days in rat pups, the distance between the upper poles of the kidneys is on average 0.40 ± 0.003 μ m, the lower poles - 0.56 ± 0.01 μ m. The distance between the upper poles of the kidneys in 21-day old rat pups was on average 0.51 ± 0.005 μ m, the lower poles - 0.79 ± 0.01 μ m.

Table 2 shows the morphometric parameters of rat kidneys in early postnatal ontogenesis.

Newbo.	15	1 - 2	0,2- 0,3	2,0 - 4,0	2,0 - 2,4	2,0 - 2,4
6 days	13	2,5- 2,7	0,3- 0,4	2,1 - 2,5	2,1 - 2,5	2,1 - 2,5
11 days	14	2,8- 3,2	0,4 - 0,5	2,3 -2,7	2,2- 2,6	2,1 - 2,5
16 days	15	3,6 - 3,9	0,5 - 0,8	2,5 - 2,9	2,4 - 2,8	2,3- 2,7
21 days	14	4,0- 4,4	0,8 - 1,0	2,8 - 3,0	2,5 - 2,7	2,3- 2,8

*Reliability error by age

Note: newbo. (Newborn)

The distance between both kidneys in newborn rats is on average $0.77 \pm 0.002 \mu\text{m}$, in 6-day old rats, this distance is on average $1.20 \pm 0.001 \mu\text{m}$. At 11 days of age, the distance between both kidneys is $1.45 \pm 0.01 \mu\text{m}$, in 16-day old rats on average $1.97 \pm 2.2 \mu\text{m}$. 21-day old rats $3.28 \pm 0.03 \mu\text{m}$.

The capacity of the kidneys in the abdominal cavity in newborn rats is on average 3.24 ± 0.06 , in 6-day old rats on average 5.10 ± 0.09 , in 11 days on average 7.32 ± 0.06 , 16 days

equals an average of 9.52 ± 0.13 , 21 days an average of 13.8 ± 0.22 .

The coefficient of organ volume in newborn rats is on average 24.0 ± 1.03 , in 6-day old rats on average 23.7 ± 0.54 , in 11-day old rats on average 19.9 ± 0.14 , in 16-day old rats on average 20.7 ± 0.59 , in 21 day old rats on average 23.8 ± 0.38 .

Table 3 shows the organometric parameters of rat kidney parameters in early postnatal ontogenesis.

Topographic and anatomical parameters of rat kidneys in early postnatal ontogenesis

Table 3

Age (days)	The number of rats	Width between kidneys		Kidney capacity (ultrasound)	Capacity in the abdomen	Organ's coefficient
		Top pole	Bottom pole			
Newbo.	15	0,28 - 0,3	0,3 - 0,35	0,64 - 0,9	2,85 - 3,65	17,8 - 31,4
6 days	13	0,29 - 0,31	0,36 - 0,4	1,16 - 1,24	4,48 - 5,52	21,4 - 27,6
11days	14	0,32 - 0,036	0,42 - 0,5	1,4 - 1,5	6,82 - 7,53	18,9 - 20,6
16 days	15	0,38 - 0,42	0,5 - 0,6	1,66 - 2,2	8,56 - 10,23	17,4 - 25,1
21 days	14	0,48 - 0,54	0,7 - 0,84	3,28 - 0,03	3,12 - 3,44	20,9 - 25,6

*Reliability error by age

Note: newbo. (Newborn)

In rats at 16 and 21 days of age, the kidneys are bean-shaped, and at 21 days it is bean-shaped.

From 16 days of age, rats switch to a mixed diet, in connection with this, in our opinion, the kidney takes the form of a bean. According to V.M. Petrenko, I.Yu. Tyaglova (2018) data, the ratio of the width and length of the human kidneys is 0.6-0.65 cm. In their opinion, the kidneys in humans and rodents are bean-shaped.

CONCLUSION

Thus, by the age of 12 months, the weight growth rate of rats increases 38.6 times, the

weight of the organ 12.06 times, the length of the kidneys 5.12 times, the thickness of the kidneys 11.33 times, about newborns. The width of the kidneys in the upper pole by the age of 12 months increases 2.06 times, at the hilum of the kidneys 1.98 times, the lower pole 1.91 times compared to newborns. According to ultrasound examination, the capacity of the kidneys in the abdominal cavity by the age of 12 months increases 12.9 times compared with the neonatal period.

The growth rate of organometric indicators of organ weight by 21 days increases by 19.0%, thickness by 31.0%, a width of the kidneys to

the levels of the upper pole by 8.0%, the distance between the kidneys to the levels of the upper pole by 21.0% about 16 days old. In connection with the transition to definitive nutrition, the growth rate increases by 21 days of age.

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