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***Mota O. M., Podoliuk M. V., Rozenkow S. O., Mariiko I. M.***

# MORPHOLOGICAL AND TOPOGRAPHIC PECULARITIES OF THE UTERUS OF FEMALE WHITE RAT

**Danylo Halytsky Lviv National Medical University (Lviv, Ukraine)**
**mota.oksana@gmail.com**

*The issue of a detailed study of the morphological features of the uterus of a female white rat, which is normally bicornuate, is quite relevant given the possibility of using it as a model of the corresponding anomaly in humans. The purpose of the work is to study the morphological and topographic features of the uterus of a female white rat. Object and methods of research. The macro anatomy and syntopy of the uterus of 8 female white rats weighing 200-230 g aged 4.5-5 months were studied. The preparation of the abdominal cavity, followed by the study of syntopy and holotopy of the uterus was carried out. Further, the uterus was removed and its morphological features were studied, the measurements were performed using a caliper and weighing on electronic scales. Results. The female uterus is found to consist of two spurs that unite to form a common cervix in the pelvic cavity, and the spurs rise into the abdomen and their tops, along with the ovaries and twisted fallopian tubes, adjoin the lower poles of the kidneys. There is an asymmetry of uterine spurs: the right spur is 0.2 cm longer than the left one on average, but the outer diameter of the left spur exceeds the same size of the right one on average by 1 mm. The weight of the uterus averages 0.88 g, which is 0.38% of the total weight of the rat. Conclusions. Morphologically, the uterus of a female rat has significant similarities to such an anomaly as a bicornuate uterus in humans. There are some differences: the spurs of the rat uterus are considerable in length and extend beyond the pelvic cavity, while the uterus of a non-pregnant woman lies only in the pelvic cavity. The ratio of uterine weight to the body weight of the female rat is 4.6 times higher than the same ratio in humans.*

***Key words:*** *uterus, female rat, morphology, syntopy.*

**Relationship of the publication with the planned research works.** The work is a fragment of the research "Structural organization, angioarchitectonics and anthropometric features of organs in the intrauterine and extrauterine periods under the conditions of exo- and endopathogenic factors", № state registration 0115000041.

**Introduction.** The experiment is of importance in medical science and remains an integral part of solving many pressing problems of modern medicine, so the issue of the comparative anatomy of human organs and experimental animals remains quite relevant. Laboratory rats are often used in biomedical research. Given the steady growth of pathology of the female reproductive system and congenital anomalies, a comparison of the morphological features of the genitals of humans and female rats is essential. According to the literature, Muellerian duct anomalies occur in 4.3-6.7% of women [1, 2]. These anomalies are divided into 7 classes: uterine agenesis – class I, unicorn uterus – class II (5%), double uterus – class III (11%), bicornuate uterus – class IV (39%), incomplete uterine membrane – class V (34%), arc uterus – class VI (7%) and T-shaped uterus – class VII (4% together with the other forms) [2-3]. Among these anomalies, the bicornuate uterus is quite common, on average, in 10-39% of women with anomalies of Muellerian ducts [4]. It is known that patients with a bicornuate uterus have a higher chance of miscarriage and premature birth (36 and 23%, respectively) [4-5]. This anomaly can cause other problems, such as dysmenorrhea, amenorrhea, abdominal pain, and recurrent pain [6-7]. The literature provides a lot of information about the structure of the reproductive system of female rats, their functions, and the relationship between them, but many of these data remain contradictory [8-10]. Normally, the uterus of white rats belongs to the bicornuate and the issue of the possibility of using it as a model of the defect in humans with the further development of new treatments and successful pregnancy and childbirth in women with this anomaly is quite relevant.

**Purpose.** To study the morphological and topographic features of the uterus of a female white rat.

**Object and methods of research.** The macro anatomy and syntopy of the uterus of 8 female white rats weighing 200-230 g aged 4.5-5 months kept in standard conditions of the vivarium of Lviv National Medical University were studied. All the manipulations were carried out under the basic principles of work with experimental animals following the "Regulations of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes" (Strasbourg, 1986), "General Ethical Principles for Animal Experiments" approved by the National Congress on Bioethics (Kyiv, 2001), the Law of Ukraine "On Protection of Animals from Cruelty" (as of February 21, 2006). After weighing the animals, they were euthanized under ether anesthesia. Then the preparation of the abdominal cavity, followed by the study of syntopy and holotopy of the uterus was carried out. Further, the uterus was removed and its morphological features were studied, the measurements were performed using a caliper and weighing on electronic scales. At the last stage, several horizontal sections of the cervix were performed to establish the junction of the cavities of the two spurs. The results of morphometric studies at the first stage of statistical processing were tested for the normality of the distribution using the Shapiro-Wilk test. Since all the obtained indicators by the nature of distribution corresponded to normal, the representation of the results through M±SD was used, where M is the arithmetic mean, and SD is the standard deviation. The level of reliability for morphometric studies was set at & = 95.

**Research results and their discussion.** It is found that the uterus of a female white rat consists of two spurs, which unite to form a common cervix, which is located in


**Figure 1 – Syntopy of the uterus of a female white rat. Marking: 1– uterus; 2 – rectum; 3 – bladder; 4 – loops of the small intestine; 5 – kidney.**


**Figure 2 – Uterus of a female white rat, rear view. Marking: 1 – cervix; 2 – left spur; 3 – right spur; 4 – vaginal canal.**

the pelvic cavity, and spurs rise into the abdominal cavity and their tops with ovaries and twisted fallopian tubes adjoin the lower poles of the kidneys. . In front of the spurs there are loops of the small intestine. The bladder is adjacent to the anterior surface of the cervix, and the rectum is adjacent to the posterior surface **(fig.1)**.

A detailed examination of the genitals revealed that the uterine cavity caudally extends into the vaginal canal, and the tops of the spurs are connected to the fallopian tubes **(fig. 2)**. It is found that the length of the left spur is 4.1 cm on average and the right is 4.3 cm. At the same time, the outer diameter of the right spur is 2.5 mm, and the left is 3.5 mm. Thus, there is an asymmetry of uterine spurs: the right spur is on average 0.2 cm longer than the left one but the outer diameter of the left spur exceeds the same size of the right one on average by 1 mm.

The length of the cervix averages 1.1 cm and the outer diameter is 5 mm. As a result of performing horizontal sections of the cervix, it is found that there are two slit-like cavities, each of which joins with the lumen of one of the spurs **(fig. 3)**. As part of the cervix, these cavities are separated by a membrane and unite only in its lower part, at a distance of 1.5 mm from its eye on average.

The weight of the uterus averages 0.88 g, which is 0.38% of the total weight of the rat; on average, a woman who has not given birth has a uterus weighing 50 g, which is 0.083% of body weight.

**Conclusions.** Morphologically, the uterus of a female rat has significant similarities to the structure of the bicornuate uterus under class IV of anomalies of Muellerian ducts. There are some differences: the spurs of the rat uterus are considerable in length and extend beyond the pelvic cavity. The ratio of uterine weight to the body

**Figure 3 – Union of two slit-like cavities in the lower part of the cervix of a female white rat.**

weight of female rats is 4.6 times higher than the same ratio in humans.

**Prospects for further research.** Investigation of the uterus of female rats at microstructural and ultrastructural levels.

## References


1. Di Spiezio Sardo A, Campo R, Gordts S, Spinelli M, Cosimato C, Tanos V, et al. The comprehensiveness of the ESHRE/ESGE classification of female genital tract congenital anomalies: a systematic review of cases not classified by the AFS system. Human Reproduction. 2015;30(5):1046-1058. DOI: 10.1093/humrep/dev061.
2. Tehrani HG, Hashemi L, Ghasemi M. Complete bicornuate uterus with complete transverse vaginal septum. J Res Med Sci. 2014;19(4):378-379.
3. Rastogi M, Revannasiddaiah S, Thakur P, Thakur P, Gupta M, Gupta MK, et al. Müllerian duct anomalies and their effect on the radiotherapeutic management of cervical cancer. Chin J Cancer. 2013;32(8):434-440.
4. Gulavi E, Kyende Mutiso S, Mariara Muriuki C, Mukaindo Mwaniki A. Pregnancy Outcome after Open Strassman Metroplasty for Bicornuate Uterus. Case Rep Obstet Gynecol. 2018;2018:4579736. DOI: https://doi.org/10. 1155/2018/4579736.
5. Sugiura-Ogasawara M, Lin BL, Aoki K, Maruyama T, Nakatsuka M, Ozawa N, et al. Does surgery improve live birth rates in patients with recurrent miscarriage caused by uterine anomalies? Journal of Obstetrics & Gynaecology. 2015;35(2):155-158. DOI: 10.3109/01443615.2014.936839.
6. Hefny AF, Kunhivalappil FT, Nambiar R, Bashir MO. A rare case of first-trimester ruptured bicornuate uterus in a primigravida. Int J Surg Case Rep. 2015;14:98-100.
7. Ouchi N, Kuwabara Y, Yonezawa M, Kurashina R, Ichikawa T, Sawa R, et al. Successful Management of Complicated Uterine Displacement Caused by Unilateral Incarceration of the Bicornuate Uterus. Case Rep Obstet Gynecol. 2019 Mar 7;2019:3205610. DOI: 10.1155/2019/3205610.
8. Vidal JD. The Impact of Age on the Female Reproductive System. Toxicol Pathol. 2017;45(1):206-215.
9. Laffan SB, Posobiec LM, Uhl JE, Vidal JD. Species Comparison of Postnatal Development of the Female Reproductive System. Birth Defects Res. 2018;110(3):163-181.
10. Podolyuk MV. Comparative anatomy of the uterine tube of human and laboratory white rat females. Reports of Morphology. 2018;24(4):47-52. DOI: 10.31393/morphology-journal-2018-24(4)-07.


**МОРФОЛОГІЧНІ ТА ТОПОГРАФІЧНІ ОСОБЛИВОСТІ МАТКИ САМКИ БІЛОГО ЩУРА**

**Мота О. М., Подолюк М. В., Розенков С. О., Марійко І. М.**

**Резюме.** Зважаючи на невпинний ріст патології органів жіночої статевої системи та вроджених аномалій, порівняння морфологічних особливостей статевих органів людини та самок щурів є вкрай необхідним. Згідно даних літератури аномалії протоків Мюллера зустрічаються у 4,3-6,7% жінок. У структурі цих аномалій дворога матка займає вагоме місце. Відомо, що у пацієнток з дворогою маткою, більш високий шанс викиднів і передчасних пологів (36 і 23% відповідно). Дана аномалія може бути причиною й інших проблем, таких як дисменорея, аменорея, біль у животі та періодичні болі. В нормі матка білого щура належить до дворогих і питання про можливість використання її як моделі відповідної вади у людини з наступною розробкою нових методів лікування і успішного ведення вагітності та прийняття пологів у жінок з даною аномалією є досить актуальним. Вивчено макроанатомію та синтопію матки 8-ми самок білих щурів масою 200-230 г віком 4,5-5 місяців. Матка самки щура складається з двох відрогів, які з'єднуються, утворюючи спільну шийку матки, котра знаходиться в порожнині малого тазу, а відроги піднімаються у черевну порожнину і їхні верхівки разом з яєчниками та покрученими матковими трубами прилягають до нижніх полюсів нирок. Маса матки у середньому становить 0,88г, що складає 0,38% від загальної маси щура; в середньому у жінки, що не народжувала, матка важить 50 г, що складає 0,083% від маси тіла. Спостерігається асиметрія відрогів матки: правий відріг довший від лівого у середньому на 0,2 см, проте зовнішній діаметр лівого відрогу перевищує аналогічний розмір правого у середньому на 1мм. Довжина шийки матки складає 1,1см, а зовнішній діаметр – 5 мм. У шийці матки наявні дві щілиноподібні порожнини, кожна з яких сполучається з просвітом одного з відрогів. Отже, морфологічно матка самки щура має значну подібність до такої аномалії як дворога матка у людини. Наявні і певні розбіжності: відроги матки щура мають значну довжину і виходять за межі порожнини малого таза.

**Ключові слова:** матка, самка щура, морфологія, синтопія.

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**Abstract.** Taking into consideration the incessant growth of pathology of organs of female reproductive system and congenital abnormalities, the comparison of morphological pecularities of human genitals and female rats is quite necessary. According to data of literature abnormalities of the Mueller ducts occur in 4,3-6,7% of women. In the structure of these abnormalities bicornuate uterus plays an important role. It is known that the patients with bicornuate uterus have much bigger chances of miscarriages and precocious delivery (36 and 23% accordingly). This given abnormality may be a reason of other problems such as dysmenorrhoea, amenorrhoea, abdominal pain and recurrent pain. The uterus of white rat in its norm belongs to bicornuate and a question about possibility of using it as a model of appropriate defect in a human being with next development of new methods of treatment and successful pregnancy management and delivery in women with given abnormality is actual enough. Macroanatomy and syntopia of the uterus of eight female white rats weighing 200-230 gr aged 4,5-5 months have been studied. The uterus of female white rat consists of two spurs, which are connected, forming common cervix of the uterus that is located in the pelvic cavity and spurs rise to abdominal cavity and their tops together with ovaries and twisted uterine tubes are adjacent to the lower poles of the kidneys. The average weight of the uterus is 0,88 gr and it is 0,38% from general weight of rat; on average, the weight of the uterus of a woman who has not given birth is 50 gr which is 0,083% of body weight. Asymmetry of uterine spurs is observed: the right spur is on average 2 sm longer than the left one, howewer, external diameter of the left spur exceeds on average 1 mm the same size of the right one. The length of cervix is 1,1 sm, and external diameter – 5 mm. There are two slit-like cavities in the cervix each of them are connected to the lumen of one of the spurs. Hence, morphologically the uterus of female rat has considerable similarity to such abnormality as bicornuate uterus in human. There are certain devergences: the spurs of the uterus of a rat have considerable length and go beyond the pelvic cavity.

**Key words:** uterus, female rat, morphology, syntopy.

**ORCID and contributionship:**
Mota O. M.: 0000-0003-4516-1169 АВДЕF
Podolyuk M. V.: 0000-0003-3490-89769 АСДF
Rosenkow S. O.: – ABF
Mariiko I. M.: ABF

**Conflict of interest:**
The authors declare no conflict of interest.

**Corresponding author**
Mota Oksana Mykolayivna
Danylo Halytsky Lviv National Medical University
Ukraine, 79010, Lviv, 69 Pekarska str.
Tel: 0988004297
E-mail: mota.oksana@gmail.com

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