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MORPHOLOGIC VARIATIONS OF THE ARTERIAL VASCULAR BRANCHES OF THE REPRODUCTIVE SYSTEM IN THE FEMALE RABBITS.

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Abstract

This paper comprises the detailed analysis of the results obtained from the examination of the morphologic variants of arterial vascular branches in the reproductive system of the female rabbits, taking into account different stages of postnatal development. As a result of this study, significant morphological diversity in the development, origin, course and tortuosity of the main vessels and their branches, which provide vascularization of the genital organs in the female rabbits, were described. The observed variabilities reflect the physiological adaptations of the vascular system to the individual anatomy of the female rabbits. The obtained results confirmed that the morphological changes, which occur in the vascular system during postnatal development, are closely related to the transformations and needs of the organs of the reproductive system.

Keywords: arteries, the female rabbits, vascular branches, organ complex, genital organs.

INTRODUCTION

The study of the morphological variations in the arterial vascular branches of the reproductive system in the female rabbits is a topic of high interest in the field of comparative anatomy and veterinary physiology [2;4]. As in other mammals, the reproductive system in the female rabbits is highly vascularized, and plays a pivotal role in providing the exchange of substances through continuous circulation in blood vessels. These vessels serve as a transportation channel for fluids, contributing to the maintenance of the physiological functions of the genital organ complex in the female rabbits [1;6;7;8].

The blood circulation occurs within a system of entirely closed blood vessels, which undergo a series of significant structural, origin and branching modifications at different stages of postnatal development [5;9].

By its changes obtained as a result of postnatal development the circulatory system ensures the constant growth and development of all organs, organ systems and the whole organism.

These morphologic changes allow adaptation of the circulatory system to the needs of structural modification of the organism, ensuring constant growth and development of organs and organ systems. In this context, the study of these changes is crucial for the understanding of the relationship between the vascular system and the functions of the reproductive system in the female rabbits, emphasising the adaptability and complexity of this biological mechanism [3;4;9].

MATERIALS AND METHODS

The study was conducted on a sample of rabbits aged between two and four months, in good health and from a well-controlled environment. The animals were slaughtered in accordance with the ethical norms and regulations in force, with a view to minimising animal suffering. The sources of vascularisation of the compartments of the genital apparatus were highlighted through the utilisation of the fine anatomical dissection method, as described by Воробьёв В.П. In order to facilitate clear visualisation of the vascular network, the blood vessels were injected with a special polymer that had been mixed with photofluorescent substances. Following the injection of the vessels with the photofluorescent polymer, the soft tissues were subjected to corrosion. The resulting models were photographed under both standard and UV lighting conditions to facilitate the visualisation of the vascular structures, which were subsequently subjected to detailed analysis.

OUR OWN RESULTS

Examination of the vascular bed of the reproductive system in the female rabbits has confirmed that the abdominal aorta (*Aorta abdominalis*) (fig. 1-1) is the main source of vascularization of the female genital organocomplex. In rabbits, the abdominal aorta has a ventro-caudal position, slightly inclined to the left of the vertebral column. At the level of the LV vertebra, the abdominal aorta emits right and left arteries ovarian (*Aa. avaricae dextra et sinistra*) (fig. 1-2), which follow a cranio-lateral course, positioning themselves along the cranial margin of the lateral ligament of the uterus, until approaching the ovary.

The ovarian arteries display considerable variation in their morphology along the entire length of the artery, contingent on the dimensions, origin, position, and tortuosity of the artery, which in turn depend on the degree of development of the genital organs in the female rabbits. These variations in the ovarian arteries influence the manner in which they adapt to the specific structure of the genital apparatus of each individual, thereby ensuring optimal blood supply to the reproductive organs.

A review of the data obtained from the examination of the ovarian arteries in female rabbits revealed significant variations in the manner of their origin from the abdominal aorta. These variations include discrepancies in the positioning of the right and left ovarian arteries, which consequently impact the vascularisation of the genital organs. It can be stated that in 50% of cases, the right ovarian artery arises more cranially than the left. In contrast, in 35.7% of cases, the opposite is true, with the left ovarian artery emerging more cranially than the right. Moreover, in 14.3% of cases, both the left and right ovarian arteries have a parallel origin, indicating a high degree of symmetry between the two vessels.

In cases of females with a cranial origin of the ovarian arteries, the respective vessels were observed to originate at the cranial pole of the fifth lumbar vertebra. In instances where the arteries exhibited a caudal origin, the source was identified at the caudal pole or at the intervertebral disc situated between the fifth and sixth lumbar vertebrae. In cases of bilateral origin, the source was identified at the level of the formation of the transverse processes of the fifth lumbar vertebra.

Another area of investigation was the analysis of the data obtained regarding the position and tortuosity of the ovarian artery and its own branches. The results of this analysis demonstrated that the ovarian arteries exhibited different cranio-caudal or cranial curves depending on their position relative to the abdominal aorta. It was observed that the left ovarian artery, at its origin, creates a cranio-caudal curve in 42.8% of cases, while the right ovarian artery has a cranial curve in the same percentage of cases. In the remaining cases, 57.2% of the examined subjects exhibited a right cranial trajectory for the ovarian arteries. Additionally, it was observed that at a distance of approximately 10.14–21.35 mm from the origin of the ovarian arteries, the right and left cranial uterine branches (*Rami uterinus cranialis dextra et sinistra*) are emitted (fig. 1-3). Subsequently, the ovarian artery directs its course towards the ovary, where it emits the ovarian branch artery (*Ramus tubarius uterinus*) (Fig. 1-4) and the ovarian proper artery (*Ramus ovaricae proper*) (fig. 1-5). Subsequently, the artery proceeds towards the uterine tube and terminates as the artery of the

uterine tube (*Ramus infundibulum tubarius*) (fig.1-6). These vessels ensure adequate vascularisation of the genital organ complex in the respective region.

As the main vessels that provide irrigation to the ovaries and fallopian tubes, the ovarian arteris branches show certain individual variations in their origin and formation. According to our study, it was observed that in 37.5% of the cases the right tubal artery has its origin separate, directly from the ovarian proper artey, while in 64.3% of the cases it originates from the trunk common to the ovarian proper artery. As for the left tuberous artery, it has in 71.4% of cases a common origin with the left ovarian proper artery, while in 28.6% of cases it showed a separate origin.

In turn, the ovarian proper artery is represented either by a single branch in 57.1% of cases or by two branches in 42.9% of cases. These branches are directed towards the ovarian parenchyma and penetrate the organ at the posterior pole in 92.3% of cases for the right ovarian proper artery and in 100% of cases for the left ovarian proper artery. The exception observed in the study was 7.7% of cases, where the right ovarian proper artery penetrates the cranial pole of the organ.

After the emission of the tubal and ovarian arteries proper, the ovarian arteries continue as the fallopian tube flag arteries which emit, from the right side, towards the anterior region of the oviducts, 2 branches of blood vessels in 42.8% of cases or one branch in 57.2% of cases. Similarly, towards the anterior region of the oviducts from the left side, 2 branches were observed in 42.8% of cases and 1 branch in 57.2% of cases. In our study, anastomosis of the artery pavilion of the fallopian tube with the ovarian arterial branch, which obtains its origin from the cranial branch of the renal artery, was observed in 35.7% of cases.In order to obtain detailed information about the arterial vascular sources of the tubular reproductive organ segments, the main branches of the abdominal aorta were examined. From the data obtained it was found that the uterine artery (*Artera uterina*) (Fig. 1-7), the main vessel vascularizing the uterus in the female rabbits, has its point of origin on the medial aspect of the external iliac artery (*Artera iliaca externa*) (Fig. 1-8) at the LVII vertebra of the vertebral column.

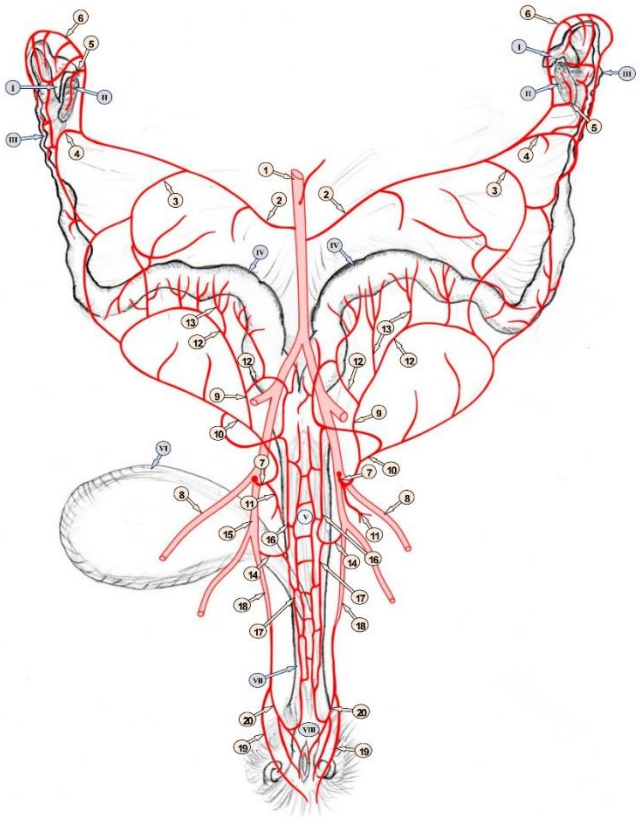


Figure 1. *Arterial branches of the reproductive system in the female rabbits, (after author).*
I - ovarian bursa; II - ovary; III - fallopian tube; IV - uterus; V - vagina; VI - bladder; VII - vaginal vestibule; VIII - vulva.

However, at the point of origin of the uterine artery or observed some variability of origin in the right and left side of the genitalia in the female rabbits. Thus, in 71.4% of the cases, the left uterine artery originates from a single trunk, consisting of the anterior (Fig. 1-9) and posterior (Fig. 1-10) uterine rr. (*Rami uterinus anteriorus et posteriorus*) and the dorsal and ventral bladder arteries. (fig. 1-11) (*Rami vesicales dorsalis et ventralis*) and in 28.6% of the cases at the base of its origin it bifurcates into the common trunk formed by the anterior and posterior uterine and the trunk formed by the dorsal and ventral bladder. The right uterine artery in all cases examined showed origin through a single trunk consisting of anterior and posterior uterine rr. and dorsal and ventral arteries bladder. The anterior and posterior uterine aa. branches all along the tract or emit a variable number of secondary (fig.

1-12) and tertiary (fig. 1-13) branches (*Rami uterinus secundaris et tertiaris*), which depends on certain age changes of the genital organocomplex segments in the female rabbits.

Thus, the rr. of the anterior and posterior uterine arteries develop and diversify as the rabbit grows. At 2 months of age, the anterior uterine branch emits 3-4 tertiary branches, and by 4 months of age the number increases to 7-8 branches. In the case of the posterior branch, 1-2 tertiary branches are present at 2 months of age and 2-3 tertiary branches at 4 months of age. These secondary and tertiary branches are essential for the vascularization of the uterine segments, creating blood microcirculation vessels in the uterine wall, which helps to maintain a healthy environment for the development and function of the reproductive organs.

The vaginal artery (*Artera vaginalis*) (fig.1-14) is a blood vessel, with its point of origin on the medial aspect of the internal iliac artery (*Artera iliaca interna*), (fig.1-15), which, having a caudo-ventro-medial direction, heads towards the vaginal vestibulum where, near it, it emits two secondary branches, one vaginal (Rami vaginalis) (fig.1-16), other the vaginal branch continues cranially towards the caudal portion of the vagina, while the vaginal vestibular branch has a medio-caudal direction and is distributed in the walls of the vagina and vaginal vestibule. As a result, in our studies, it was observed that the secondary branches of the artery vaginalis along their entire projection emit 2-4 tertiary branches at the age of 2 months and 5-6 branches at the age of 4 months.

The internal pudendal artery (*Arteria pudenda interna*) (fig. 1-18) represents the terminal branch of the internal iliac artery and plays an essential role in the vascularisation of the terminal compartment of the reproductive system in the rabbit. At the level of the ischial arch, on the lateral faces of the external genitalia, two vascular branches are emitted: the dorsal (fig. 1-19) and ventral (fig. 1-20) (*Rami pudendis dorsalis et ventralis*). The dorsal branch extends to the anal region, where it contributes to the irrigation of the terminal portion of the digestive system, particularly the rectum. The ventral branch extends caudo-ventrally, giving rise to two secondary branches, the lateral and medial branches, which provide vascularisation for the vulva and clitoris. These vascular branches form a network that is essential for the optimal health and function of the external genitalia and the terminal portion of the digestive system.

CONCLUSIONS

- Taking into account the above, we can confirm that the arterial vascularization of the genital organs in the rabbit, despite their diversity in terms of development, origin, course and tortuosity, is provided by the following main vessels: ovarian, uterine, vaginal and internal pudendal arteries, which, through their secondary and tertiary branches, ensure efficient irrigation of all segments of the reproductive system in the female rabbits during the postnatal growth period.
- Analysis of the vascular bedding of the reproductive system in female rabbits' mares during the postnatal growth period revealed complex and variable characteristics, reflecting physiological adaptations of the vascular system to the individual anatomy of each female rabbits and demonstrating a direct impact on the way genitalia are vascularized.
- As female rabbits develop, vascular branching becomes more numerous, providing an increasingly rich vascularization of each segment of the genital organocomplex, which supports both the functional requirements of organ growth and preparation for reproductive and physiological maturity.

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