ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Macro-morphology Of The Intramural Arterial Bed Of Jejunum Of Newborn Lambs Of The North Caucasian Breed.

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ABSTRACT

Morphological studies of the animal organism are fundamental with respect to the age aspect and are of great importance for applied biological and veterinary sciences. The study of the intestine and its blood channels are necessary for establishing the species and age features of the physiology of intestinal digestion, for improving the feeding of animals, for treatment and preventing intestinal diseases. The purpose of our scientific research is to investigate the macromorphology of the intramural arterial bed of the jejunum of newborn lambs of the North Caucasian breed. The performed scientific work has a great importance for comparative, age and breed anatomy of animals, as it contains new data on the features of intramural angioarchitecture of the jejunum of newborn lambs of the North Caucasian breed. The methodological basis of the researchconsist of a systematic analysis of accessible literature that creates theoretical prerequisites for studying the features of the anatomy of the intramural arterial bed of the jejunum of newborn lambs of the North Caucasian breed. It will allow improving feeding, methods of treatment and prevention of intestinal diseases of sheep. The research results were obtained using anatomical and statistical research methods. The features of the meatus, topography and branching of the intramural arteries of the jejunum of newborn lambs of the North Caucasian breed were studied for the first time. In this research, the number of different types of intramural arteries of the jejunum in the neonatal period of development of animals has been established; and features of anatomy of intra-bed and inter-bed anastomosis have been described in detail. The obtained results of the study can be used in establishing the characteristics of intestinal digestion of newborn lambs and in improving the feeding regimes of animals, treatment and preventing intestinal diseases.

Keywords: intestine, artery, intramural, anastomosis, plexus.

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ISSN: 0975-8585

INTRODUCTION

Sheep breeding is of great relevance for the national economy of Russia as a source of food and raw materials for consumer goods industry. The deep and comprehensive study of the structure, physiology of the animal's organism, its specific features and adaptive variability is necessary for the intensive development of this animal husbandry branch.

The circulatory system as one of the integral systems of the body ensures that the necessary level of metabolism in it is maintained. The supply to the circulatory bed of nutrients, macro-microelements and vitamins is provided by the thin and thick parts of the intestine. Normal functioning of the intestine is possible if optimal blood supply is provided. Defects of both extra-organ and intramural blood flow in the intestine can lead to the development of pathologies.

Studies of the morphology of the circulatory bed of ruminant animals have been described in the scientific works of Alaev A.N. [1], Gruzdev P.V., [2], Kasatkin S.N. [3], Kasatkin S.N., Lipchenko V. Ya., Samusev R. P. [4], Malofeev Yu.M., Chebakov S.N. [5], Porublyov V.A. [6], Aralina E.A. [7], Hummel R., Schnorr B. [8], May M. S., Neil D. S. [9], Tanudiamadja K., Getti R. [10], Trukhachev V.I., Porublyov V.A., Agarkov N.V, Botasheva T.I. [11] and others. At present, the features of the macroscopic structure of the intra -organ arterial bed of the jejunum of the sheep of the North Caucasian breed in postnatal ontogenesis remained practically unexplored. All of the formergave occasion to the basis for a detailed study of the anatomy of the intramural arterial bed of the jejunum of newborn lambs of the North Caucasian breed.

The research objective is to study the macromorphology of the intramural arterial bed of the jejunum of newborn lambs of the North Caucasian breed.

MATERIALS AND METHODS

The study material ware 10 intestines of the newborn lambs of the North Caucasian breed. They were obtained from animals at the slaughterhouse unit of the agricultural production co-operative “Vostok” in Stepnovskiy region of the Stavropol Territory, Verhnestepnoy village, Russia. These animals were clinically healthy, were slaughtered in accordance with the Directive 2010/63 / EU of the EUROPEAN PARLIAMENT AND OF THE COUNCIL OF THE EUROPEAN UNION on the animal protection, which are used for scientific purposes.

The following methods were used in the study: preparation; injection of blood vessels with contrasting specificweights (components: frost-resistantink, glycerin and distilled water in the ratio of 1: 1: 4); dissection of the intestinal wall on the mucous, muscle and serosa membranes; morphometry and macrophotography. Determination of the number of departures under acute, the right and obtuse angles of long, medium and short, single- and double-barreled, lepto-aureal and euryareal arteries and their anastomosis was carried out using the classification developed by professor Kasatkin S.N. et al. [3, 4].

Statistical analysis of the obtained digital data was carried out using one-way ANOVAand Newman-Keuls multiple comparisons test in the program "Primer of Biostatistics 4.03" for Windows. Differences at $p \leq 0,05$ were considered reliable.

RESULTS

As a result of the research it has been established that the blood supply to the jejunal wall is not carried out by all of its length through the intramural arteries;they leave the jejunal arteries (Figure 1) and mesenteric arcades of 1-3 orders, which are branches of the jejunal trunk cranial mesenteric artery.

Intramural arteries of the jejunum are formed by dividing the direct vessels emerging from the bed of the jejunal arteries and their mesenteric arcades. During separation of each straight artery in the area of the mesenteric border of the jejunum, two intra-arterial arteries, as well as one, less often two small branches, are formed, which are directed into the serous membrane of the intestine and take part in its blood supply.

ISSN: 0975-8585

Each of the intramural arteries is guided from the mesenteric border of the jejunum to its serous membrane, where it gives returnsinto back numerous small branches, which form a subserous arterial plexus with cells of various shapes and sizes.

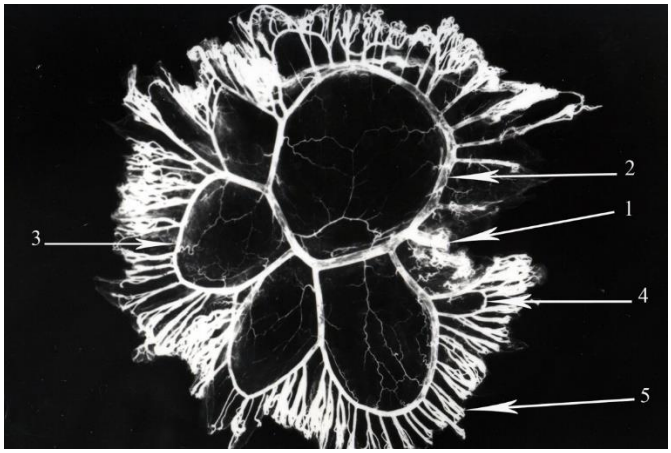

Figure 1: Mesenteric arcades and end arteries of the jejunum of newborn lams of the North Caucuses breed (Injection of contrast weight with frost-resistant ink)
1 – jejunal artery; 2 – primary mesenteric arcade; 3 – secondary mesenteric arcade; 4 – tertiary mesenteric arcade; 5 – end arteries of the jejunum

Hereafter the intramural arteries consistently pass the outer longitudinal and inner annular layers of the jejunum muscular coat forming a muscular arterial plexus. Small branches of the intraorgan arteries are oriented along the muscle fascicles of each of the layers of the jejunum muscular coat, giving transverse anastomosis to proximal branches. Thus arterial cells of rectangular, trapezoidal and irregular forms are formed, evidently to serve unhindered intramural blood flow in the muscular coat of the jejunum with various functional loads on its wall.

The intramural arteries after exiting the jejunum muscular coat are routed to the submucosa of its mucosa. There it is finally divided into the most significant submucosal plexus (Figure 2), which takes part in the blood supply not only to the tissues of the mucosa, but by giving back arterial branches. It also assuresbringing blood into the muscular coat of the intestine.

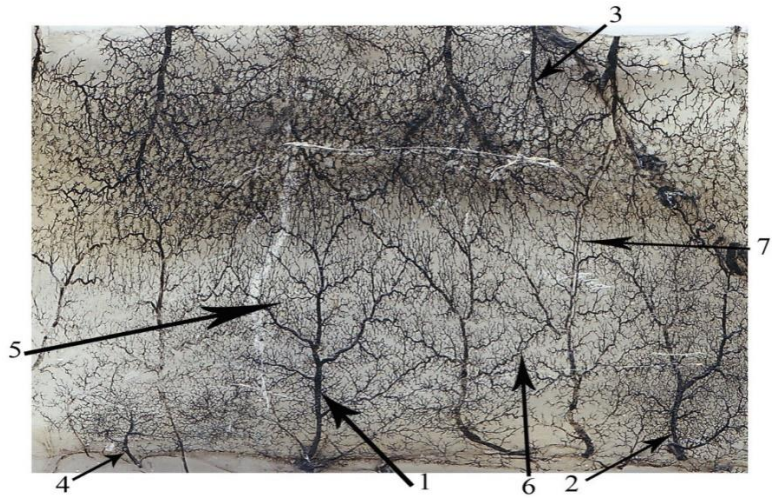

Figure 2: Submucosal arterial plexus of jejunum of newborn lamb of North Caucasian breed (Injection of contrast weight with frost-resistant ink)
1 – single-barrel long lepto-areal artery; 2 – double-barrel long lepto-areal artery; 3 – middle single-barrel lepto-areal artery; 4 – short single-barrel lepto-areal artery; 5 – intra-bed anastomosis; 6 – inter-bed proximal anastomosis; 7 – inter-bed contralateral anastomosis.

Thus, numerous conjugation tubes or anastomosis where observed between the mucosa and the muscular coats, which can act as collateral for various defects of intramural blood flow in the main vascular tubing lines of the jejunal wall.

Long, medium and short intramural arteries occur in the submucosal arterial plexus of the jejunum, where they extend from the main vascular tubing lines mainly under oblique, rarely than right and in obtuse angles. According to the number of trunks there are only single- and double-barreled arteries.Across the width of the vascular pool there are lepto-areal and euryareal vessels (Figure 2).

Data on the number and types of intramural arteries of the jejunum of newborn lambs are presented in Table 1.

Table 1: Types of intramural arteries of the jejunum and their number in newborn lambs of the North Caucasian breed

Classification of arteries	Type of arteries	Number of arteries, M±m
Trunk length	Long	2166,40±129,20
	Middle	599,40±37,20
	Short	324,40±29,20
Number of barrels	Single-barrel	2266,20±56,80
	Double-barrel	829,60±53,20
	Three-barrel	-
	Multi-barrel	-
Branch-angle	Arteries extend at sharp angle	2034,80±48,80
	Arteries extend at right angle	695,20±50,80
	Arteries extend at an obtuse angle	369,60±21,20
Width of the vascular pool	Lepto-areal	3002,20±236,80
	Euryareal	91,20±14,80

As can be seen from the data in Table 1, the longest arteries extending from the jejunal arteries,- mesenteric arcades predominantly at an acute angle and leading to the free edge of the jejunum, where they enter terminoterminal anastomosis with vessels of the opposite side, - are the dominant type of vessels along the length of the trunk. Single-barreled arteries occur in a much larger number (Table 1).They have sharp angles along the main type of numerous branches that participate in the formation of adjacent inter-bed anastomoses. The double-barreled arteries, which are less frequent, divide the vascular trunk into two branches. By the level of distribution, juxtavesical arteries and vessels with an average division level are most often found. In single cases, double-barreled arteries of the juxtabasal branch level are registered.

On the width of the vascular pool in the wall of the jejunum of newborn lambs dominate the vessels of the narrow-field, or lepto-aural type with the index 25-40 (Table 1). Arteries of euryareal type were few on all studied preparations (Table 1) and had a vascular index of 60-90.

Numerous anastomoses form between the intramural arteries and their branches. According to topography, there isintra-bed, inter-bed adjacent and inter-bed contralateral (Figure 2 - 5, 6, and 7). According to form, thereare straight, sinuous, arc-like, angular and reticular connections. In the line they are longitudinal, transverse and oblique.

On the caliber of connecting branches there are equally- and various-caliber anastomoses. Among intra-bedanastomosis of the jejunum of newborn lambs, the angular form of oblique direction of equal caliber prevails. Inter-bed anastomoses are characterized as compounds of basically rectilinear, tortuous forms of equal caliber and longitudinal directions. Among the inter-bed opposite anastomoses, the most common are compounds of equal caliber, rectilinear, sinuous forms of transverse and oblique directions.

CONCLUSION

- Intramural arteries form three intramural arterial plexuses such as subserous, muscular and submucous in the jejunum of newborn lambs of the North Caucasian breed. The most significant among them is the submucous arterial plexus. It takes part in the blood supply of not only the tissues of the mucous membrane, but also transports arterial blood to the muscular membrane by returning through branches.
- There are long, medium and short intramural arteries in the submucous arterial plexus of the jejunum. They extend from the main vessels mainly under oblique rarely right and obtuse angles. There are only single- and double-barreled arteries according to the number of trunks.There are lepto-areal and euryareal vessels along the width of the vascular pool. Long single-barreled vessels of the leptoareal type predominate among the intramural arteries. They extend from the jejunal arteries and mesenteric arcades mainly at an oblique angle.
- Numerous anastomosisforms exist between the intramural arteries and their branches. According to the topography they are intra-bed, inter-bed adjacent and inter-bed opposite. Their forms are straight, arc-like, angular and reticular connections, in the direction there are longitudinal, transverse and oblique. On the caliber of connecting branches there is equally- and various-caliber anastomosis.
- The angular form compounds of obliquity of equal caliber prevail among intra-bed anastomosis of the jejunum of newborn lambs. Inter-bed anastomosis is characterized as compounds of basically rectilinear and sinuous shape of equal caliber and longitudinal direction. The most common among the inter-bed opposite anastomosisare compounds of equal caliber rectilinear and sinuous forms of transverse and oblique directions.

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