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Features Changes In The Morphometric Parameters Of The Organ Circulatory Grid Of The Cattle Stomach.

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ABSTRACT

The aim of the study was to study the dynamics of the morphometric parameters of organ blood vessels of the muscular type of the grid of the stomach of cattle in certain periods of postnatal ontogenesis and the establishment of patterns of their development. The research materials were 75 cattle stomachs taken from animals of six age groups: newborns, 1 month, 3 months, 6 months, 18 months and 3 years, healthy for gastrointestinal diseases. The age morphology of the bloodstream of the mesh was studied by injection, histological and morphometric methods. The obtained morphometric parameters were processed by the method of variation statistics. It has been established that in newborn animals, organ vessels of the muscular type branch in a submucosa up to the third order, and in adults - up to the seventh order. The dynamics of morphometric parameters are characterized by the most significant increase in the diameters of the arteries and veins of the first and second orders during the period of intensive growth of animals, i.e. aged from one month to eighteen months. In newborn animals in the submucosa, the largest arteries have up to 5-6 layers of myocytes in the media, veins - 3-4 layers. Simultaneously with an increase in the diameter of the vessels, their wall thickness increases with age. Organ veins accompany the arteries, often one artery of the muscular type is accompanied by two companion veins. Transverse anastomoses form between the companion veins. The dynamics of the increase in the diameter of the veins occurs with a high degree of reliability. The diameter of the fourth and fifth order organ veins in the period from six to eighteen months increases by 1.5, 2.0 and 2.3 times, which is associated with a decrease in the number of smooth muscle cells in the vascular wall with an increase in the order of branching and an increase in their depositing function.

Keywords: vessels, ruminants, cattle, multi-chamber stomach, digestive apparatus.

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INTRODUCTION

Ruminants are unique due to their selectivity in nutrition and their ability to digest roughage, providing the necessary level of metabolism (Pelagalli, 2007). The beginning of the arrival of vegetable feed in the gastrointestinal tract of the calf is normally accompanied by adequate changes in all body systems (Beloborodchenko, 2014; Clauss, 2010).

The grid of the multi-chamber stomach of ruminants is a unique, multifunctional organ directly involved in the chewing process, on which cows depend on both milk production and general health, which affects the economic efficiency of milk production (Buryakov, 2016). Despite the general principle of its structure in small and cattle, the size of the grid in these animals is different, which is probably due to the characteristics of feed capture (Meshcheryakov, 2008; Wang, 2014; Swan, 2000). In this connection, it is necessary to study the adaptive rearrangements of the mesh in postnatal morphogenesis (Vivo, 1990; Franco, 2012), and especially its structural components, such as the blood stream, because Many issues affecting the formation of the vascular bed of a multi-chamber stomach are not well understood (Shpygova, 2018).

As is well known, the sources of the blood supply to the mesh are the reticular (a. Ruminoreticularis) and left ventricular (a.gastroepiploica sinistra) arteries, its trough feeding occurs through intraparietal arteries extending from the reticular, left ventricular, left cicatricial and left common gastric arteries, from which the mesh wall includes organ arteries of the first order (Chebakov, 2013).

Objective: to study the dynamics of the morphometric parameters of the organ circulatory grid of the cattle stomach.

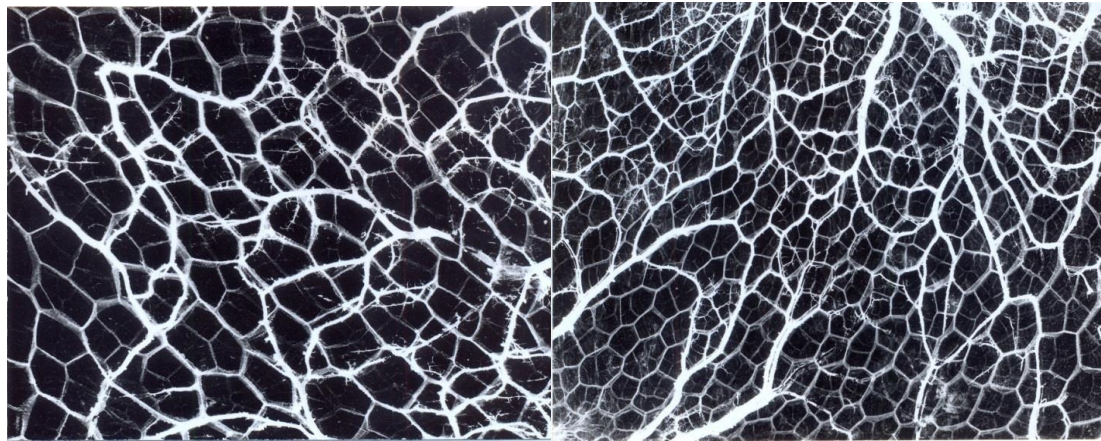
The objectives of the research were to study the morphometric parameters of the arterial and venous link of the organ vessels of the bloodstream of the grid in certain periods of postnatal ontogenesis and to identify patterns of their development.

MATERIALS AND METHODS

For studies, 75 cattle stomachs were taken from clinically animals of six age groups: newborns, 1 month, 3 months, 6 months, 18 months, 3 years (Taurus, 2001). Slaughter of calves aged from 1 day to 3 months was carried out with a scientific and production purpose. All manipulations were carried out on the slaughterhouses of the Stavropol Territory in compliance with Directive 2010/63 / EU of the European Parliament and the Council of the European Union of September 22, 2010 on the protection of animals used for scientific purposes. Slaughter of animals of older age groups was carried out in order to obtain products of animal husbandry. The age-related morphology of the bloodstream of the mesh was studied by injection, histological and morphometric methods. The injection of vessels was carried out through the celiac artery and the gastro-splenic vein with a contrast substance – barium sulfate with glycerin, or a solution of 5% frost-resistant carcass with gelatin, followed by the stratification of the stomach wall into four shells and enlightenment of drugs. To obtain the histological sections, pieces of the walls of the mesh were fixed in 10% zabuferenne solution of neutral formalin, dehydrated in alcohols of increasing concentration, enlightened in xylene, sealed in paraffin, preparing sections with thickness of 5-7 μm , and stained them with hematoxylin and eosin for scoping studies and pikrofuksin by Van Gieson for the detection of connective tissue. Statistical analysis included methods of descriptive and inductive statistics. The data at $p < 0.05$ were considered reliable.

RESULTS AND DISCUSSION

It has been established that first-order vessels extending from the main arteries supplying the grid give arterioles to the serosa, forming microvascular units - modules in the form of polygonal cells oriented mainly along the organ. Then, having transferred the vessels into the muscular layer, in the submucosa, arterial muscles of the muscular type branch up to the third order in newborn animals, to the fourth order in three months, to the fifth order in six months and to the seventh in adult animals (Figure 1).



a)

b)

Figure 1: The blood vessels of the submucosal plexus of the bottom of the mesh a) arterial plexus; b) venous plexus. Age of 6 months, filling of vessels with barium sulphate with glycerin; 76% of full size.

Age-related changes in the diameter of the first-seventh order organ blood vessels are listed in Table 1.

Table 1: The diameter of the organ arteries of the muscular type of cattle mesh (n = 15)

Organ arteries	The diameter of the vessels by age groups (mm)					
	Newborns	1 month	3 months	6 months	18 months	3 years
1st order	0,77±0,10	0,89±0,11*	1,16±0,11*	1,53±0,10*	2,21±0,11*	2,32±0,11*
2nd order	0,50±0,11	0,67±0,13*	0,87±0,13*	1,19±0,14*	1,54±0,13*	1,61±0,13*
3rd order	0,24±0,11	0,26±0,11	0,45±0,11*	0,61±0,14*	0,93±0,10*	1,04±0,13*
4th order	-	-	0,23±0,10	0,34±0,11*	0,72±0,14*	0,73±0,13
5th order	-	-	-	0,26±0,11	0,61±0,11*	0,61±0,14
6th order	-	-	-	-	0,39±0,10	0,43±0,10
7th order	-	-	-	-	0,22±0,09	0,23±0,10

Note: the statistical significance of differences with an earlier period:

*-p<0,05

The diameter of the first-order arteries increased in monthly animals compared to newborns by 16%, in three months compared with months - by 30%, in six months compared with three months - by 32%, in eighteen months compared to six months - by 44%. In three-year-old animals, the difference from the previous age group was 5%.

The diameter of the second-order vessels also increased in all age groups with a high degree of confidence. In newborn animals in the submucosa, the largest arteries have up to 3-4 layers of myocytes in the media, veins - 1-2 layers. Simultaneously with an increase in the diameter of the vessels, their wall thickness increased with age. Thickening of the wall was noted by increasing the number of layers of media and adventitia smooth muscle cells.

Organ veins accompany the arteries, often one artery of the muscular type is accompanied by two companion veins. Transverse anastomoses form between the companion veins. The dynamics of the increase in the diameter of the veins occurs with a high degree of reliability (Table 2).

Table 2: The diameter of the organ veins of the muscular type of cattle mesh (n = 15)

Organ veins	The diameter of the vessels by age groups (mm)					
	Newborns	1 month	3 months	6 months	18 months	3 years
1st order	1,01±0,18	1,33±0,13*	1,75±0,16*	2,38±0,22*	3,34±0,19*	3,55±0,21*
2nd order	0,74±0,14	1,06±0,18*	1,32±0,14*	1,79±0,20*	2,32±0,20*	2,32±0,23
3rd order	0,31±0,10	0,35±0,11*	0,67±0,15*	0,93±0,15*	1,44±0,24*	1,51±0,18
4th order	-	-	0,27±0,10	0,41±0,11*	0,82±0,14*	0,84±0,18
5th order	-	-	-	0,29±0,10	0,69±0,16*	0,70±0,16
6th order					0,47±0,13	0,49±0,11
7th order					0,30±0,08	0,32±0,09

The greatest changes are in the first-order muscle veins. The diameter of the second-order vessels reliably increases only in the period of active growth of the animal: from birth to 1 month by 43%, from one month to three months by 25%, from three to six months by 36%, from six to eighteen by 30%, respectively. In older age groups, the diameter of the veins of the second order does not increase, which is possibly due to an increase in the number of these vessels.

The diameter of the vessels of the third order in the period of active growth of the animal: from one month to eighteen months increases by 13%, 91%, 39% and 55%, respectively.

The diameter of the fourth and fifth order venous vessels between the reliably distinguishable groups increased 1.5, 2.0 and 2.3 times, respectively, which we associate with a decrease in smooth muscle elements in the wall and an increase in their depositing function.

The diameter of the satellite satellites in newborn animals is 1.2 times in adults - 1.5 times more than the arteries (Figure 2).

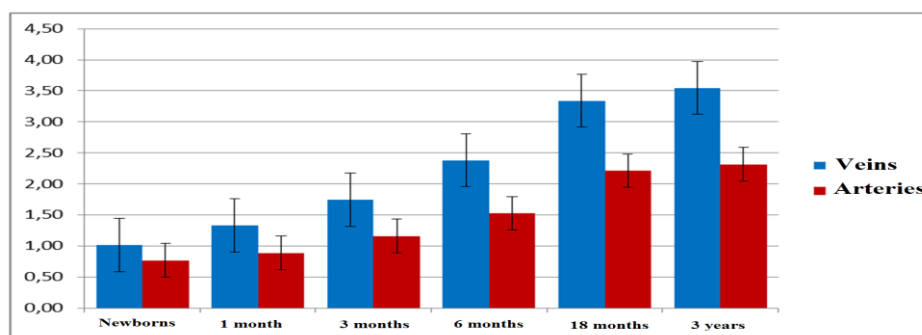


Figure 2: The ratio of the diameters of the organ arteries and veins of the muscular type of the first order of the cattle mesh.

CONCLUSION

Thus, the dynamics of the morphometric parameters of the organ circulatory grid of the cattle stomach is characterized by the most significant increase in the diameters of the arteries and veins during the period of intensive growth of animals, i.e. from birth to eighteen months. The diameter of the fourth and fifth order organ vessels in the period from six to eighteen months increases by 1.5, 2.0 and 2.3 times, which is connected in the arteries with an increase in smooth muscle cells in the median sheath — media, depositing function as the order of branching increases. The venous unit of the organ bed undergoes more significant changes as compared with the arterial one, especially during the formation of vessels of the 3-4th order.

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