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MORPHOLOGICAL ASPECTS OF THE CELIAC ARTERY IN SHEEP CORRELATED WITH THE STAGES OF DEVELOPMENT OF THE GASTRIC COMPARTMENTS

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Abstract:

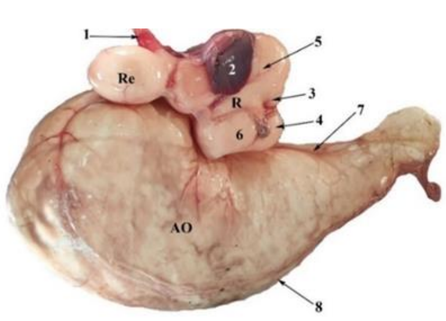
The study of the development of the digestive system in ruminants, especially the gastric compartments, has been and still is a subject of interest to many researchers. The main characteristic of adult ruminants is their ability to consume large amounts of forage, which they break down into simpler, easily absorbed components.
The different development of the gastric compartments, depending on the age of the animal and the type of feeding, leads to variations in the morphology and topography of the arteries supplying these components of the digestive tract. The aim of this research is to identify possible variations in the celiac artery in terms of its origin and its collaterals and to observe whether these variations are the result of changes in the proportions between gastric compartments. Similar aspects regarding the vascularization have been observed in individuals belonging to different age groups, but also some differences, such as: origin of the celiac artery (from a common trunk with the cranial mesenteric artery, but also independent from the aorta artery), numerical and topographical variations of the splenic artery.

• Introduction

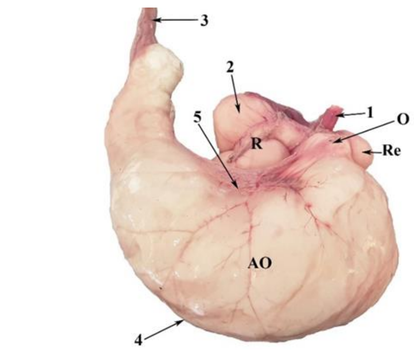
The understanding of the arteries branching from the abdominal aorta (their origin, the presence of atypical variants of common artery origin or the presence of additional arteries) plays an important role in the diagnosis and treatment of some digestive pathologies, as well as in surgical interventions concerning the abdominal cavity. The possibility of variations in the trajectory and origin of celiac artery collaterals has a significant impact on the difficulty of surgery and the risks that may occur during surgery..
However, details on the particularities of the celiac artery in small ruminants according to the age category of the animal are missing, and morphological correlations between the calibre and distribution of the branches of the celiac artery and the size of the gastric compartments at different stages in their developmental dynamics as a result of changes in diet, are very briefly described.

• Material and method

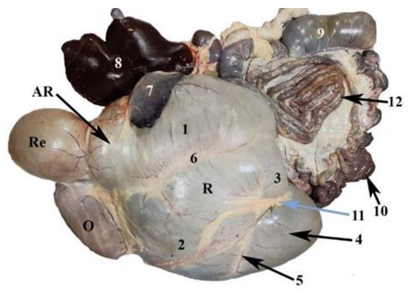
The study was conducted on 5 lamb carcasses aged between 2 and 3 days and one adult small ruminant carcass. The animals used in the study came from breeding farms and were destined for dissection and research in the Comparative Anatomy Laboratory of the Faculty of Veterinary Medicine in Bucharest.
The most common method used was dissection. The aortic artery was revealed and the site of origin of the celiac artery was observed. A low-viscosity epoxy resin (mixed with a red pigment to highlight the arterial vascularization) was injected centrifugally at this level. Thus, the contrast substance reached the branches of the celiac artery through the celiomesenteric trunk. To make conclusive measurements of the stomach in the ruminant, a moderate amount of polyurethane foam was introduced inside the gastric compartments.



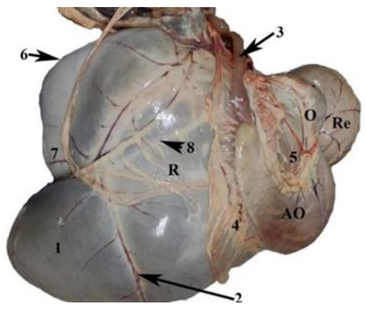
Gastric compartments in newborn lamb - left side (original)
R- rumen; Re- reticulum; AO- abomasum; 1- esophagus; 2- spleen; 3- caudodorsal blind sac; 4- caudoventral blind sac; 5- dorsal ruminal sac; 6- ventral ruminal sac; 7- lesser curvature of abomasum; 8- greater curvature of abomasum



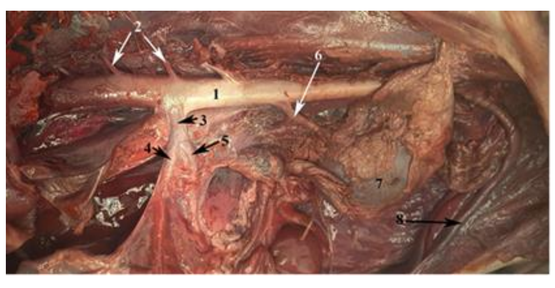
Gastric compartments in newborn lamb - right side (original)
R- rumen; Re- reticulum; O- omasum; AO- abomasum; 1- esophagus; 2- dorsal ruminal sac; 3- duodenum; 4- greater curvature of abomasum; 5- lesser curvature of abomasum



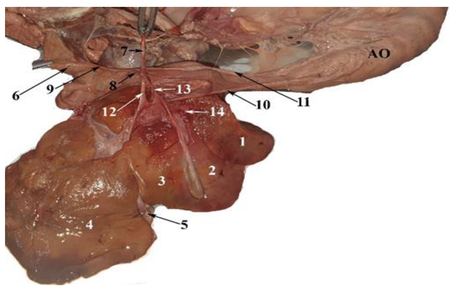
Gastric compartments of the adult small ruminant - left side (original)
R-rumen; AR- ruminal atrium; Re- reticulum; O- omasum; 1- dorsal ruminal sac; 2- ventral ruminal sac; 3- caudodorsal blind sac; 4- caudoventral blind sac; 5- ventral coronary groove; 6- left accessory groove; 7- spleen; 8- liver; 9- caecum; 10- jejunum; 11- caudal groove; 12- ascending colon



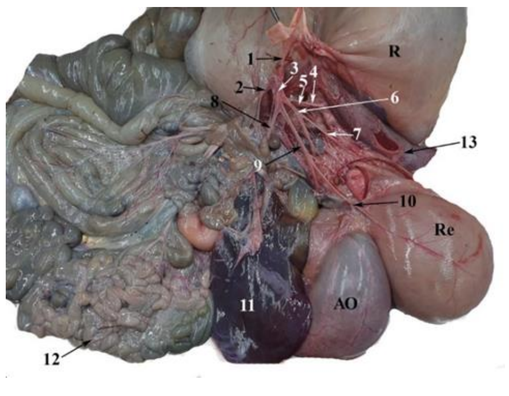
Gastric compartments of the adult small ruminant - right side
R- rumen; Re- reticulum; O- omasum; AO- abomasum; 1- caudoventral blind sac; 2- ventral coronary groove; 3- duodenum; 4- the greater omentum; 5- the lesser omentum; 6- dorsal curvature of the rumen; 7- caudodorsal blind sac; 8- right longitudinal groove



Origin of the celiomesenteric trunk (original)
1- abdominal aorta; 2- lumbar branches; 3- celiomesenteric trunk; 4- celiac artery; 5- cranial mesenteric artery; 6- renal artery; 7- left kidney; 8- umbilical artery



Terminals of the hepatic artery in newborn sheep (original)
AO-abomasum; 1- caudate lobe; 2- right hepatic lobe; 3- quadrate lobe; 4- left hepatic lobe; 5- umbilical artery; 6- duodenum; 7- hepatic artery; 8- gastro-duodenal artery; 9- cranial pancreatico-duodenal artery; 10- right gastric artery; 11- right gastro-epiploic artery; 12- left branch; 13- right branch; 14- branch for caudate lobe



The main collaterals of the celiac artery in the adult ruminant
R-rumen; Re-reticulum; AO- abomasum
1- the common celiomesenteric trunk; 2- cranial mesenteric artery; 3- celiac artery; 4- splenic artery; 5- right ruminal artery; 6- left ruminal artery; 7- reticular artery; 8- hepatic artery; 9- left gastric artery; 10- accessory reticular artery; 11- liver; 12- jejunum; 13- spleen

• Results and discussions

The special development of the stomach in ruminants consists in its division into rumen, reticulum, omasum and abomasum. A very important aspect of compartmentalization is the change in the proportions of the resulting components in close correlation with the age of the animal and the type of feed. In the pictures below, the differences between gastric compartments in newborn and adult are illustrated. In the young animals examined in the research, maternal milk was the only source of food. In these animals, the strong development of the abomasum, which is the only compartment involved in milk digestion, is remarkable. This also implies a topographical change of the digestive organs in the abdominal cavity, with the rumen, reticulum and abomasum projecting on the left side of the cavity.
Between the bodies of the first two lumbar vertebrae (L1-L2), ventral to them, the common celiomesenteric trunk branches off from the abdominal aorta and after a 0.5 cm course divides into the celiac artery and the cranial mesenteric artery. In one specimen, the celiomesenteric trunk was absent, the celiac artery branching independently from the abdominal aorta, before the origin of the cranial mesenteric artery, at a distance of about 0.2 mm from it.
Therefore, **the celiac artery** (*A. celiaca*) branches above the dorsal ruminal sac and emits 3 branches: hepatic artery, left gastric artery and splenic artery.
The hepatic artery (*A. hepatica*) splits off from the celiac artery near the origin of the left gastric artery. The hepatic artery orients towards the visceral side of the liver, entering at the level of the hepatic hilum and divides into 2 branches: right and left. In all specimens examined, **the right gastric artery** was seen to detach from the left branch of the hepatic artery approximately 1 cm from the origin of this branch.
Before the division of the hepatic artery into two branches, **the gastro-duodenal artery** (*A. gastroduodenalis*), which has a short path (0.5 cm), separates. This, in turn, divides into **the right gastro-epiploic artery** (*A. gastroepiploica dextra)* and **the cranial pancreato-duodenal artery** (*A. pancreaticoduodenalis cranialis*).
The left gastric artery after a 2 cm path from its origin, gives the left gastroepiploic artery which follows the reticulo-omasal junction on the right side, sends 2 reduced branches on the right side of the omasum, then reaches the lesser curvature of the abomasum. The left gastric artery after following a third of the length of the lesser curvature, deduplicates for about 4 cm, then anastomoses with the right gastric artery.
The accessory reticular artery, reduced in development, branches off from the gastric artery, irrigating the right side of the reticulum
The splenic artery (*A. lienalis*) runs to the left to reach the splenic hilum, where it enters the parenchyma of the organ. After the separation of the two collaterals: the right ruminal artery and the left ruminal artery, in one specimen the splenic artery is duplicated for 2.5 cm. The two ruminal arteries have a reduced calibre, making it difficult to follow their course due to the poor development of the rumen in newborn lambs. **The reticular artery** is reduced in caliber and separates from the left ruminal artery
In the adult ruminant, the splenic artery and the left ruminal artery have been observed to split into a common trunk, thus the celiac artery emits four main collaterals: splenic artery, hepatic artery, left gastric artery and left ruminal artery. In contrast to young specimens where the left ruminal artery represented a collateral of the splenic artery.
In newborn animals, both ruminal arteries originated from the splenic artery. Also, the left gastric artery and hepatic artery appear to form a common trunk for about 0.5 cm.

• Conclusions

In 17% of the cases examined the celiac artery detaches independently from the aortic artery, in the remaining specimens a common celiomesenteric trunk is formed.
The most significant variations were noted in the splenic artery, with the possibility of a common trunk separation with the left ruminal artery. Also, in newborn lambs the splenic artery emits two main collaterals: the left ruminal artery and the right ruminal artery, poorly developed in this age group, consistent with the fact that the rumen is not yet functional. In 10% of newborns, it was observed that the splenic artery doubled over a 2.5 cm course before entering the splenic hilum.
Detailed studies on the celiac artery, but also the possibilities of variations of its branches are needed, both on different age groups, but also taking into account the different sheep breeds and their particularities.