



## Morphological Studies on the Venous Drainage of the Stomach in Goat

Reda Mohamed<sup>1\*</sup>, Zein Adam<sup>2</sup>, Mohamed Gad<sup>3</sup> and Shehata Soliman<sup>4</sup>

<sup>1</sup>Department of Basic Veterinary Sciences, School of Veterinary Medicine, Faculty of Medical Sciences, University of the West Indies, Trinidad and Tobago & Anatomy and Embryology Department, Faculty of Veterinary Medicine, Beni Suef University, Egypt.

<sup>2&3</sup>Anatomy and Embryology Department, Faculty of Veterinary Medicine, Beni Suef University, Egypt.

<sup>4</sup>Cytology and Histology Department, Faculty of Veterinary Medicine, Beni Suef University, Egypt.

Corresponding author: **Reda Mohamed\***: e-mail: [Reda.mohamed@sta.uwi.edu](mailto:Reda.mohamed@sta.uwi.edu)

### Abstract

Seventeen adult healthy goats of either sex were used to demonstrate the venous drainage of the stomach. Immediately after slaughtering of goat, the portal vein was injected with gum milk latex (colored blue) with ultramine. The study revealed that the different parts of stomach of the goat were drained via the branches of the portal vein. The rumen was drained by the right and left ruminal veins as well as ruminal branches from the reticular vein. The reticulum was drained by reticular branches of reticular and accessory reticular veins. The omasum was drained by omasal branches of the left gastric vein. While the abomasum was drained abomasal branches of the left gastric, left gastroepiploic, right gastric and right gastroepiploic veins. The omentum was drained by epiploic branch and omental branches. The veins of stomach appeared to be of two types, large and medium sized veins. Both types have similar intima and media, while the adventitia of large sized veins contained longitudinal bundles of smooth muscle fibers and fibroelastic connective tissue housing vasa vasorum and nervi vasorum. The adventitia of the medium sized vein was free from the longitudinal bundles of smooth muscle fibers.

**Keywords:** Anatomy, Goat, Histology, Stomach, Veins.

### Introduction

Goats characterized by their smooth management, economic cheap housing, high fertility rate and are of great economic value, being a cheap meat, milk and some industrial substances. The morphological studies of the venous drainage of the stomach in goat in the available literatures were lacking some data, except for the brief description which was given by Horowitz and Venzke (1966) and Yadm, Gad and Ragab (1992). Therefore, the present investigation aimed to describe fully the veins of the stomach in goat, regarding the origin, course and ramifications, in attempt to gain basic information which might be beneficial in

the field of caprine surgery and also contribute to the comparative ruminant animals.

### Materials and Methods

The present investigation was carried out on a total of 17 apparently healthy goats of different ages and both sexes ranging from 20-30 kg. body weight. The animals were collected from the faculty farm and from several local farms. For gross dissection of the veins of the stomach, 15 goats were used immediately after slaughtering. A longitudinal incision was made in the

midventral line of the abdominal wall starting from the xiphoid cartilage of the sternum till the anus, followed by ligating the portal vein close to its entrance into the porta hepatis. Then the portal vein was injected with gum milk latex colored blue with ultramine in a retrograde manner according to the method of Heath (1968) and Awaad (2001). Careful gross dissection of the veins of the stomach was performed either before or after embedding in 10% formalin solution for 2-3 days. For microscopical studies, 2 goats were used. Small pieces from some veins of stomach were obtained, immersed in 10% neutral buffered formalin for 24 hours then washed carefully under running tap water, dehydrated in ascending grades of ethanol, cleared in xylene, impregnated in soft paraffin and then embedded in hard paraffin to obtain paraffin blocks. Serial paraffin thin sections of about 5-7  $\mu$ m thick were taken using rotary microtome and then mounted on clean and dry glass slides. The stained with Harris Haematoxyline and Eosin as well as Crossman's trichrome stains as outlined by Drury and Wallington (1980). The nomenclature employed in this study was in accordance with that of the Nomina

Anatomica Veterinaria (2005) and the available literatures whenever possible.

## Results

### I- Gross Anatomy

The stomach of the goat was drained by branches of the portal vein.

#### Portal vein:

The portal vein (Figs. 1, 4) left the porta of the liver and soon detached the gastroduodenal veins, then it passed dorsal to the hepatic artery, entering the free border of the lesser omentum and divided into splenic veins and cranial mesenteric vein.

#### Splenic vein:

The splenic vein (Figs. 1, 4) emanated from the left aspect of the portal vein detached right ruminal vein, reticular vein, and epiploic branch then then completed its course as the left gastric vein.

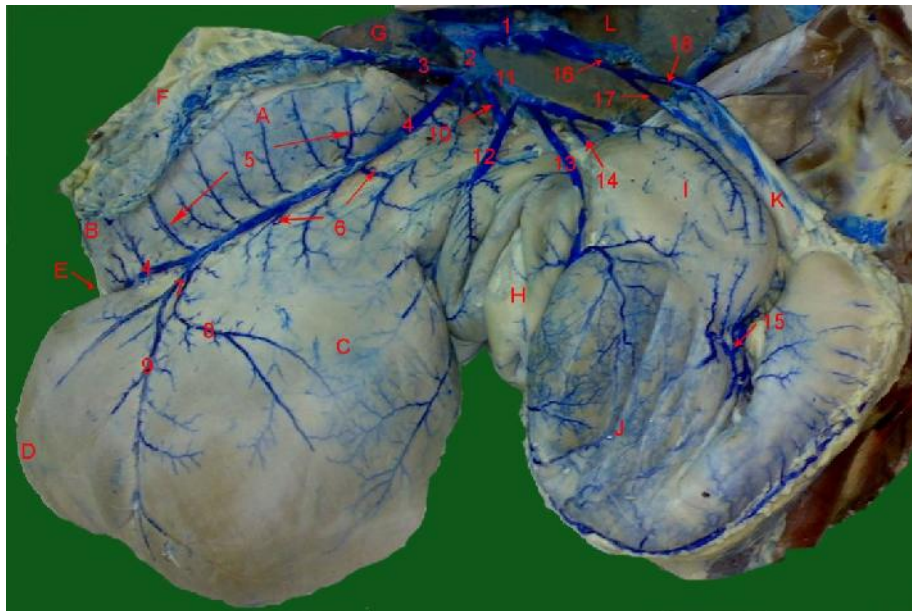


Fig., (1): A photograph showing the origin and distribution of the splenic vein (left side) :

A- Dorsal ruminal sac, B- Caudodorsal blind sac, C- Ventral ruminal sac, D- Caudovernal blind sac, E- Caudal groove, F- Greater omentum, G- Spleen, H- Reticulum, I- Omasum, J- Abomasum, K- Cranial part of the duoemum, L- Liver, 1- Portal vein, 2- Splenic vein, 3- Epiploic branch, 4- Right ruminal vein, 5- Dorsal ruminal branches, 6- Ventral ruminal branches, 7- Right ventral coronary vein, 8- Cranial branch, 9- Caudal branch, 10- Reticular vein, 11- Left gastric vein, 12- Left ruminal vein, 13- Left gastroepiploic vein, 14- Accessory reticular vein, 15- Visceral omasoabomasal branch, 16- Gastroduodenal vein, 17- Right gastric vein, 18- Right gastroepiploic vein.

### Right ruminal vein:

The right ruminal vein (Fig. 1) was detached from the splenic vein passed in the right longitudinal and caudal grooves to gain the left side of the rumen where it terminated by left dorsal and left ventral coronary veins. During its course, the right ruminal vein gave off dorsal ruminal branches, ventral ruminal branches, deep ruminal branches and right ventral coronary vein. The dorsal ruminal branches were cranial and caudal branches to drain the visceral face of the dorsal ruminal sac and caudodorsal blind sac of the rumen. The ventral ruminal branches were cranial and caudal branches to drain the visceral face of the ventral ruminal sac and caudoventral blind sac of the rumen.

The deep ruminal branches drain the right longitudinal, caudal and coronary grooves of the rumen. The right ventral coronary groove drained had cranial and caudal branches to drain the ventral ruminal and caudoventral blind sacs.

The left dorsal coronary vein (Fig.2) was one of the two terminal branches of the right ruminal vein which drained the dorsal ruminal sac and the left face of the caudodorsal blind sac. While the left ventral coronary vein (Fig. 2) was considered as the other terminal branch of the right ruminal vein which drained the ventral ruminal and caudoventral blind sacs and anastomosed with branches of both the left ruminal and right ventral coronary veins.

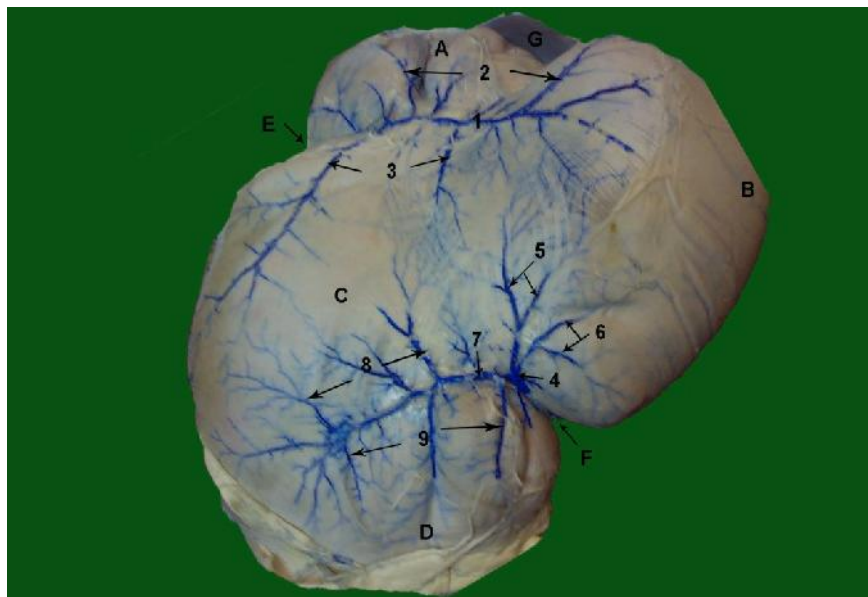


Fig., (2): A photograph of the left side of the rumen of the goat showing the distribution of the left dorsal and left ventral coronary arteries of the right ventral vein and the distribution of the left ruminal vein.

A Dorsal ruminal sac, B- Caudodorsal blind sac, , C- Ventral ruminal sac, D- Caudoventral blind sac , E- Cranial groove, F- Caudal groove, G- Spleen, 1- Left ruminal vein, 2- Dorsal ruminal branches, 3- Ventral ruminal branches, 4- Left dorsal coronary artery, 5- Cranial branches, 6- Caudal branches, 7- Left ventral coronary artery, 8- Cranial branches, 9- Caudal branches.

### Epiptic branch:

The epiptic branch (Fig. 1) was emanated from the splenic vein just ventral to the left lobe of pancreas. It gained the visceral lamina of the greater omentum and drained it.

### Reticular vein:

The reticular vein (Figs. 1, 3, 5) originated from the splenic vein. It ran within the ruminoreticular groove .it gave ruminal branches which drained the ruminal atrium and dorsal ruminal sac, reticular branches which drained the cardia and the diaphragmatic face of the reticulum and deep branches which drained the ruminoreticular groove.

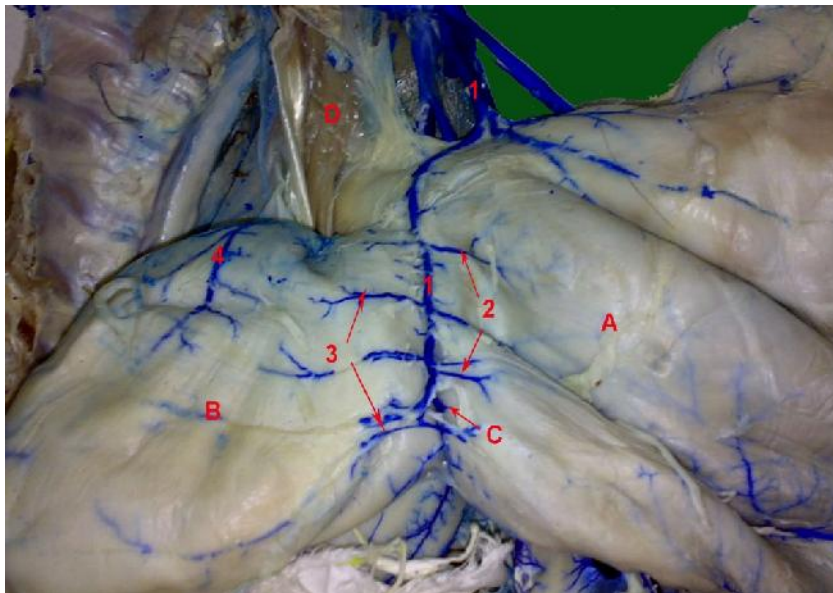


Fig., (3): A photograph showing the origin and distribution of the reticular vein of the goat. (Left side):

- 1- Rumen, B- Reticulum, C- Ruminoreticular groove, D- Liver, 1-Reticular vein, 2-Ruminal branches, 3- Reticular branches.

#### **Left gastric vein:**

The left gastric vein (Figs. 1, 4, 5) was considered as the direct continuation of the splenic vein. It passed between the liver and the dorsal ruminal sac and terminated by a visceral and a parietal omasoabomasal branch. During its course, the left gastric vein gave off the left ruminal vein, accessory reticular vein, omasal branches, omasoabomasal branches and left gastroepiploic vein. The left ruminal vein gave dorsal ruminal branches which drained the parietal face of the rumen, ventral ruminal branches which drained the parietal face of the ventral ruminal sac and deep ruminal branches which drained the left longitudinal groove.

The accessory reticular vein (Figs. 1, 4, 5) released omasal branch which drained the parietal face of the omasum, reticular branches to drain the visceral face of the reticulum and small twigs to drain the reticuloomasal junction then it continued its course to the diaphragmatic face of the reticulum. The omasal branches drained the parietal and visceral faces of the omasum.

The omasoabomasal branches (Figs. 4, 5) were considered as the termination of the left gastric vein at the omasoabomasal junction. They were represented by a parietal and a visceral branch which drained caudally on the respective aspect of the abomasum. They drained the omasoabomasal junction and the lesser omentum via small twigs. Each omasoabomasal branch detached omasal and abomasal branches to drain the corresponding surfaces of the omasum and abomasum, respectively.

The left gastroepiploic vein (Figs. 1, 5) was the largest among the collaterals of the left gastric vein. It ran along the greater curvature of the abomasum up to the pylorus of the abomasum. Throughout its course, it detached reticular branches to drain the reticulum, omasal to drain the visceral face of the omasum, parietal and visceral omasoabomasal branches to drain the respective aspects of omasum, abomasum and omasoabomasal junction, abomasal branches to drain the greater curvature of the abomasum and omental branches to drain the greater omentum.



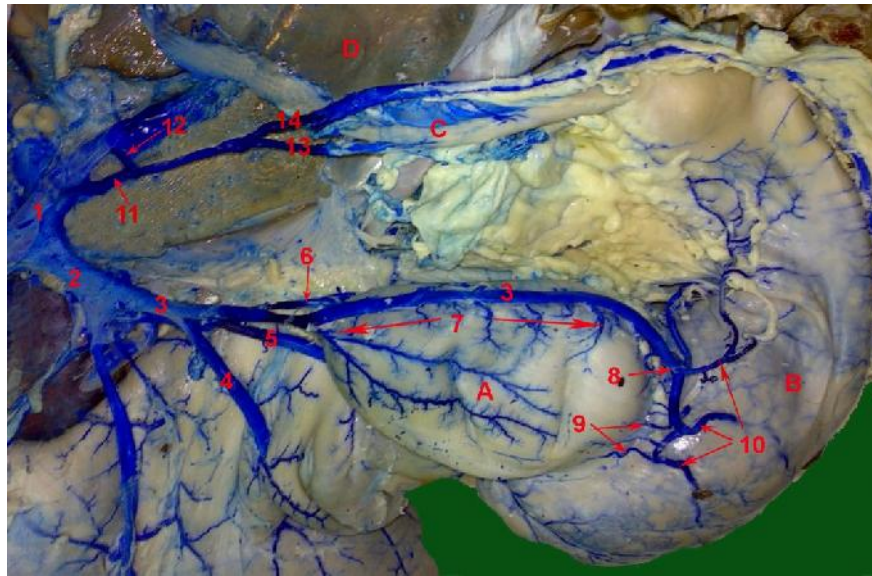


Fig., (4): A photograph showing the distribution of the Left gastric vein of the goat. (Left side):

A- Omasum, B- Abomasum, C- cranial part of duodenum, D- Liver, 1- portal vein, 2- Splenic vein, 3- Left gastric vein, 4- Left ruminal vein, 5- Left gastroepiploic vein, 6- Accessory reticular vein, 7- Omasal branches, 8-Visceral omoasoabomasal branch, 9- Visceral omasal branches, 10- Visceral abomasal branches, 11- Gastroduodenal vein, 12- Cranial pancreaticoduodenal vein, 13- Right gastric vein.

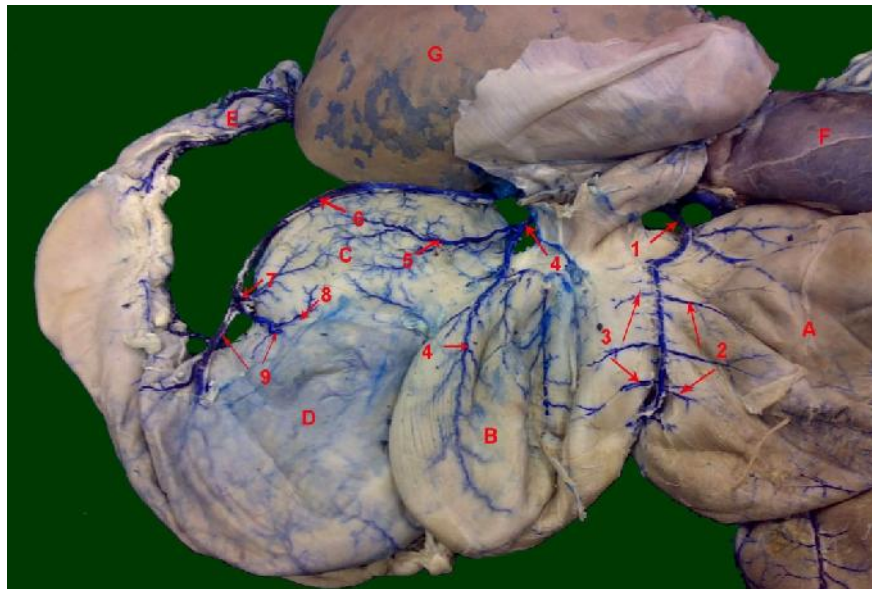


Fig., (5): A photograph showing the origin, course and distribution of the accessory reticular vein of the goat. (right side):

A-Rumen, B- Reticulum, C- Omasum, D- Abomasum, E- Cranial part of duodenum, F- Spleen G- Liver, 1- Reticular vein, 2- Ruminal branches, 3-Reticular branches, 4- Accessory reticular vein, 5- Omasal branch, 6- Left gastric vein, 7- Parietal omoasoabomasal branch, 8- Parietal omasal branches, 9- Parietal abomasal branches.

#### **Gastroduodenal vein:**

The gastroduodenal vein (Figs. 1, 4) was emanated from the right aspect of the portal vein. It gave off cranial pancreaticoduodenal vein then it ran along the sigmoid loop of the cranial part of the duodenum

towards the abomasum and terminated by bifurcation into right gastric vein and right gastroepiploic vein. The right gastric vein divided into visceral and parietal branches to drain the respective surfaces of the lesser curvature of the abomasum and drained also the lesser omentum. The right gastroepiploic vein ran along

the greater curvature of the abomasum and a long its course it gave abomasal branches to drain the greater curvature of the abomasum and omental branches to drain the greater omentum.

## II- Microscopical studies

### Portal vein:

The portal vein appeared as a typical large sized vein. The tunica intima formed of a single layer of flattened

endothelial cells with elongated flattened nuclei. It rested on thin fibrous connective tissue. The tunica media appeared thinner than the tunica adventitia and consisted of many circular smooth muscle fibers intermingled with collagen fibers. The tunica adventitia represented the thickest layer of the wall and formed of fibroelastic connective tissue housing numerous longitudinal bundles of smooth muscle fibers. Vasa vasorum, nervi vasorum as well as lymph vessels were also noticed in the tunica adventitia (Fig. 7). It gave off splenic and cranial mesenteric veins.

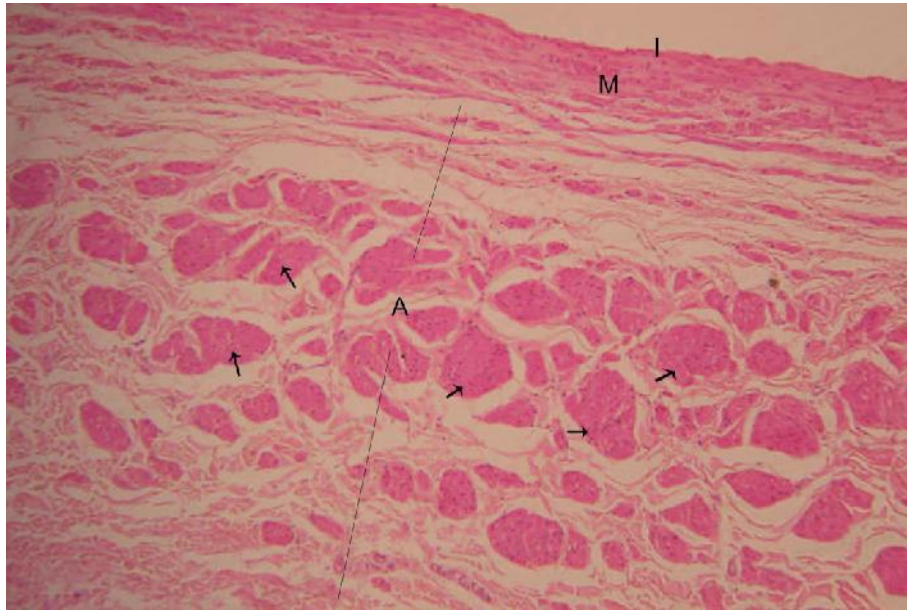


Fig., (6): A photomicrograph of the wall of portal vein showing Tunica intima (I), thin Tunica media (M) and a thick Tunica adventitia (A). Notice the longitudinally arranged smooth muscle fibers (Arrow)(H&E stain X100)

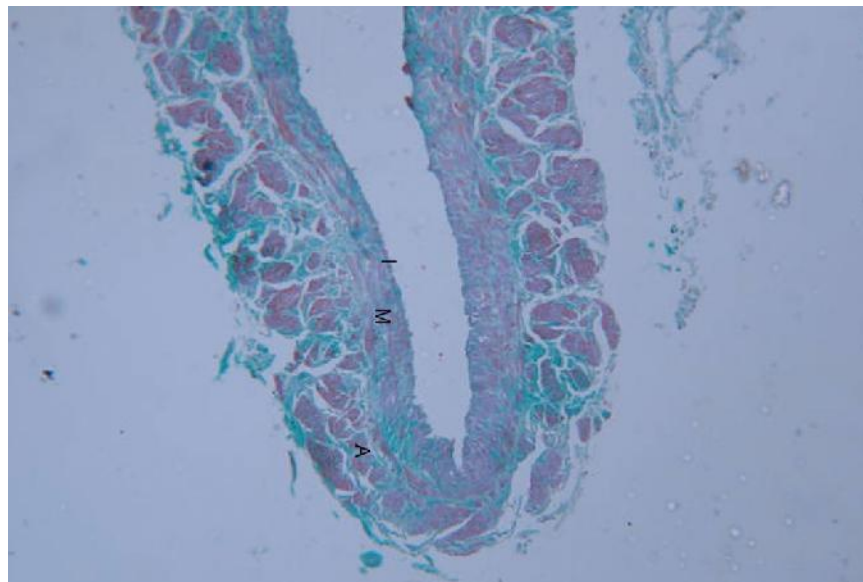


Fig., (7): A higher magnification of splenic vein showing Tunica intima (I), Tunica media (M) and thick Tunica adventitia (A). (Crossman's Trichome stain, X100)

### Splenic vein:

The splenic vein represented a typical large vein. The tunica intima of the splenic vein resembled that of the portal vein while, the tunica media is thinner and consisted of circularly arranged smooth muscle fibers

intermingled with collagen fibers. The tunica adventitia was thicker than the media and like of the portal vein consisted of fibroelastic connective tissue housing numerous longitudinal bundles of smooth muscle fibers, in addition to vasa vasorum, nervi vasorum and lymph vessels (Fig. 8).

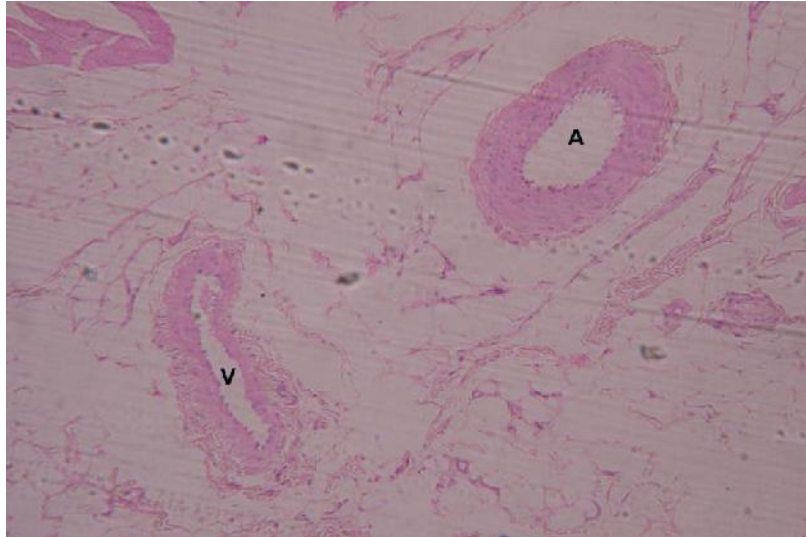


Fig., (8): A photomicrograph of left gastroepiploic artery (A) and left gastroepiploic vein (V). (H&E stain X100)

The left gastric vein gave off left gastroepiploic, left ruminal and accessory reticular veins as well as omasoabomasal branches. The above mentioned veins were classified microscopically as medium sized vein (Fig. 9). The tunica intima formed of a single layer of flattened endothelial cells resting on thin loose connective tissue. The tunica media appeared thinner than the adventitia and consisted of circularly arranged smooth muscle fibers intermingled with collagen fibers, whereas the tunica adventitia represented the outer most layer and consists of fibroelastic connective housing vasa vasorum, nervi vasorum and lymph vessels.

### Discussion

The current investigation revealed that the portal vein gave off splenic, cranial mesenteric and gastroduodenal veins simulated that reported in goat (Horowitz and Venzke, 1966; Yadm et al., 1992 and Constantinescu, 2001), ruminants (Ghoshal et al., 1981) and camel (Smuts and Bezuidenhout, 1987).

Our findings showed that the splenic vein detached right ruminal, reticular, left gastric veins and an epiploic branch. However, Horowitz and Venzke (1966) in the same animal mentioned that the splenic vein gives off the right ruminal and reticular veins.

While, Yadm et al., (1992) in goat, Ghoshal et al., (1981) in ruminants reported that the splenic vein splitted into right ruminal, left ruminal, reticular and left gastric veins. However, Heath (1968) in sheep reported that the splenic vein gives off right ruminal vein and epiploic branch. Moreover, Smuts and Bezuidenhout (1987) in camel reported that the splenic vein gives off left gastric and gastroduodenal veins.

Our investigation achieved that the right ruminal vein gave off dorsal, ventral and deep ruminal branches as well as the right ventral coronary vein; similar observations were also reported by Horowitz and Venzke (1966) in goat. However, Yadm et al., (1992) in the same animal and Ghoshal et al., (1981) in ruminants stated that the right ruminal vein gives off only dorsal and ventral branches.

The current study revealed that the right ruminal vein terminated on the left side of the rumen as a left dorsal and a ventral coronary vein, a result which passed in a line with that obtained in goat by Horowitz and Venzke (1966). However, on the left side of the rumen, the right ruminal vein released short branches to drain the caudal ruminal blind sacs, in addition to the right aspect of the dorsal and ventral ruminal sacs in goat (Yadm et al., 1992) and ruminants (Ghoshal et al., 1981).



The recent work agreed with Heath (1968) in sheep and Wilkens and Munster (1981) in ruminants in a fact that the epiploic branch arose as a collateral tributary from the splenic vein. However, Horowitz and Venzke (1966) in goat stated that the epiploic branch is a terminal tributary of the right ruminal vein.

It was observed here that the reticular vein gave off ruminal, reticular and deep branches, similar observation was reported by Horowitz and Venzke (1966) in goat. However, Yadm et al., (1992) in the same animal stated that the reticular vein detaches twigs to the cardiac orifice, ruminal atrium, in addition to the adjacent portion of the dorsal ruminal sac. While, Ghoshal et al., (1981) in ruminants reported that the reticular vein drains the reticulum, left wall of the rumen and the ruminal atrium.

It was asserted here that the left gastric vein gave off left ruminal, accessory reticular and left gastroepiploic veins, in addition to omasal and omasoabomasal branches, a result which passed parallel with that observed by Horowitz and Venzke (1966) in goat. However, Yadm et al., (1992) in the same animal and Ghoshal et al., (1981) in ruminants reported that the left gastric vein divides into right and left branches. The former gives off reticular branch and gastric branches while, the left branch continues as left gastroepiploic vein.

The current study in goat revealed that the left gastric vein terminated as a parietal and a visceral omasoabomasal branch which detached omasal and abomasal branches. The same statement was obtained by Horowitz and Venzke (1966) in the same animal, but they added another visceral and parietal branches to the abomasum alone..

The recent results were identical with those registered by Horowitz and Venzke (1966) in goat, where the left ruminal vein arose from the left gastric one. However, Yadm et al., (1992) in goat, Ghoshal et al., (1981) in ruminants reported that the left ruminal vein arises directly from the splenic vein.

The present findings as well as those of Yadm et al., (1992) in goat agreed that the left ruminal vein gave off dorsal and ventral ruminal branches. Moreover, our study added deep ruminal branches to drain the cranial and left longitudinal ruminal grooves.

The obtained results showed that the accessory reticular vein of the left gastric vein gave off an omasal branch and continued to the diaphragmatic

surface of the reticulum to anastomose with the branches of the reticular vein, a fact which also reported by Horowitz and Venzke (1966) in goat. While, Yadm et al., (1992) in the same animal denied the detachment of an omasal branch from the reticular vein, moreover, they also observed that the diaphragmatic face of the reticulum is devoid of any branches.

The study under investigation showed that the left gastroepiploic vein gave off reticular, omasal, abomasal, omasoabomasal, and omental branches, confirming observations of Horowitz and Venzke (1966) in goat. However, Yadm et al., (1992) in the same animal and Ghoshal et al., (1981) in ruminants stated that the left gastroepiploic vein detaches gastric branches to drain the omasum and abomasum as well as epiploic branches to drain the omentum.

The obtained results were parallel to those described by Horowitz and Venzke (1966) in goat, Heath (1968) in sheep, Ghoshal et al., (1981) in ruminants, Sisson and Grossman (1969) in ox and Wally (1986) in camel who mentioned that the gastroduodenal vein arises from the portal vein. While, However, Smuts and Bezuidenhout (1987) in camel mentioned that the gastroduodenal vein arises from the splenic vein.

The findings of Yadm et al., (1992) in goat, Ghoshal et al., (1981) in ruminants as well as Moustafa et al., (1986) in camel affirmed our results where the gastroduodenal vein gave off cranial pancreaticoduodenal, right gastric and right gastroepiploic veins. However, Horowitz and Venzke (1966) in goat mentioned that the gastroduodenal vein gives off cranial pancreaticoduodenal and right gastroepiploic veins.

In agreement with that recorded by Horowitz and Venzke (1966) and Yadm et al., (1992) in goat and Ghoshal et al., (1981) in ruminants, the present study stated that the right gastric vein gave off abomasal and duodenal branches to drain abomasum and duodenum and anastomosed with the corresponding left one. Moreover, our study mentioned also that the drainage of the lesser omentum occurred via small omental branches of the right gastric vein, simulated that given by Horowitz and Venzke (1966) in goat. While, Smuts and Bezuidenhout (1987) in camel reported that reported that the right gastric vein drains the lesser curvatures of the omasum, abomasum as well as the reticulum.



The findings of Horowitz and Venzke (1966) and Yadm et al., (1992) in goat and Ghoshal et al., (1981) in ruminants were also discovered in our study as the right gastroepiploic vein gave off abomasal, duodenal and omental branches and anastomosed with the corresponding left one.

Regarding the veins of our study, they appeared in two forms, large and medium sized veins. Generally, the wall of the veins consists of three layers named the tunica intima, thin tunica media and thick adventitia (Bloom and Fawcett, 1986).

As mentioned in our study, large and medium sized veins have the same tunica intima and media. Regardless variation in thickness, the intima was formed of a single layer of flattened endothelial cells resting on thin fibrous connective tissue while, the tunica media was formed of circularly arranged smooth muscle fibers intermingled with collagen fibers. These results were in accordance with Young and Heath (2000).

As mentioned by many authors, the tunica adventitia of large veins as portal and splenic veins in our study was characterized by the presence of numerous longitudinal bundles of smooth muscle fibers.

Young and Heath (2000) confirmed that the presence of longitudinal bundles of smooth muscle fibers give more strength to the venous wall as well as they support the large vein. On the other hand, the adventitia of medium sized vein described in the present work formed of fibroelastic connective tissue but devoid of longitudinal smooth muscles, these result which agreed with that of and Burkitt et al., (1993).

## Acknowledgments

I am very grateful to the technical staff and lab assistances in the Department of Anatomy and Histology for their assistance.

## References

1. Awaad, A. 2001. Gross anatomical studies on the liver of the goat. MVSc. Thesis, faculty of Vet. Med., Beni-Suef, Cairo University, Egypt.
2. Bloom, W., and Fawcett, W. 1986. A text book of Histology. 11th ed., W.B. Saunders Company, Lgaku-Shoin / Saunder: 367- 393.
3. Burkitt, H., Young, B., and Heath, J. 1993. Wheaters functional Histology (A text and colour atlas) 3rd ed., Churchill Livingstone Medical division of Longman group UK Ltd: 143-151.
4. Constantinescu, G.2001. Guide to regional ruminant anatomy based on the dissection of the goat. 1st ed., Iowa state university press / Ames. pp. 104 -131.
5. Drury, R., and Wallington, T.1980. Carleton's Histological technique. 4th ed., Oxford Univ. Press. Oxford, New York, Tronto.
6. Ghoshal, N. Koch, T., and Popesko, P.1981. The venous drainage of the domestic animals. W.B. Saunders Company. Philadelphia TrontoSydeny. pp. 139-140, 145-147
7. Heath, T.1968. Origin and distribution of portal vein in the sheep. *Am. J. Anat.* 122: 95-106.
8. Horowitz, A., and Venzke, W.1966. The distribution of blood vessels of the postdiaphragmatic digestive tract of the goat. Coeliac trunk – gastroduodenal and splenic tributaries of the portal vein. *Am. J. Vet. Res.* 27 (120): 1293-1315.
9. Moustafa, M., Abu-Zaid, S., EL-Nahla, S., and Wally, Y.1986. Some anatomical observations on the venous drainage of the intestinal tract of the one humped camel (*Camelusdeomedarius*). *Alex. J. Vet. Sci.* 2 (2): 57-69.
10. Nomina Anatomica Veterinaria. (2005. 5th edition, prepared by the international Committee on Veterinary Gross Anatomical Nomenclature (I.C.V.G.A.N.) and authorized by the General Assembly of the World Association of Veterinary Anatomists (W.A.V.A.) Knoxville, TN (U.S.A.) 2003. *Published by the Editorial Committee Hanover, Cloumbia, Gent, Sapporo.*
11. Sisson, S., and Grossman, H.1969. The anatomy of the domestic animals. 4th ed., W. B. Sauders Company, Philadelphia and London. pp. 726-730
12. Smuts, M., and Bezuidenhout, A. 1987. Anatomy of the Dromedary. Clarendon press, Oxford: 156-170, 175-177.
13. Wally, Y.1986. Some anatomical observations on the intestinal tract of the one humped camel (*camelusdromedarius*). MVSc Thesis, Faculty of Vet. Med., Cairo University, Egypt.
14. Wilkens, H. and Munster. 1981. The circulatory system. In Nickel, A., Schumer, R. and Seiferle, E. (1981): The anatomy of the domestic animals, Vol. III. Trans. By Siller, W. G. and P.A. Wright Verlag Paul Parey, Berlin und Hamburg. pp. 159-183, 260-268.

15. Yadm, Z., Gad, M., and Ragab, G. 1992. Venous drainage of the gastrointestinal tract in the goat. *Beni-Suef, Vet. Med. J.* 40 (3): 129-136.
16. Young, B., and Heath, J. 2000. Wheater's functional histology, A text and colour atlas. 4th ed., Edinburgh, London, New York, Oxford, Philadelphia, Sydney, Toronto: 147-155.

<b>Access this Article in Online</b>	
	<b>Website:</b> <a href="http://www.ijarbs.com">www.ijarbs.com</a>
	<b>Subject:</b> <b>Veterinary Sciences</b>
<b>Quick Response Code</b>	

**How to cite this article:**

Reda Mohamed, Zein Adam, Mohamed Gad and Shehata Soliman. (2016). Morphological Studies on the Venous Drainage of the Stomach in Goat. *Int. J. Adv. Res. Biol. Sci.* 3(8): 79-88.