GROSS MORPHOLOGICAL STUDIES ON THE SPLEEN OF ONE HUMPED CAMEL (*CAMELUS DROMEDARIUS*)[#]

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ABSTRACT

We investigated the gross morphometric features of the spleen of One-humped camel (*Camelus dromedarius*). A total of 6 spleens from healthy slaughtered camels were examined. Spleen was situated in the left dorsal part of the abdominal cavity, just above the dorso-caudal face of the rumen. It was much smaller in proportion to the body weight and size. The spleens of camel appeared dark brown in colour. It was crescent shaped with blunt and rough edges. The average spleen weight was recorded as 365 gm, the average volume of spleen was 470 ml, and the average length of the spleen was recorded as 45cm at the longest portion in present study. The average width of the spleen at widest portion was 14 cm and the average thickness of the dorsal, medial and ventral aspect of spleen was 0.595 cm, 1.213 cm and 0.448 cm, respectively.

Keywords: Camel, gross morphology, spleen

Introduction

According to Melvin and William (1996), spleen is more complex than other lymphoid tissues and is an important reservoir of blood. Its capsule contains large amount of smooth muscle fibers controlled by sympathetic nervous system, so it gets constricted during exercise, after hemorrhage, in carbon monoxide poisoning, during the administration of certain anesthetics (chloroform, ether) and in emotional states to fulfill the immediate requirements of the blood. The spleen is concerned with the destruction of erythrocytes as it removes aged and abnormal ones from the circulating blood. The present study has been planned to study the gross structure of the spleen (the largest lymphoid organ) to justify its importance and essentiality in the body asit performs various functions like heamatogenesis, metabolizes iron, blood filtrationand immune response.Spleen, located between the stomach, left kidney and diaphragm, is the largest lymphoid organ in the body, performing functions for the blood similar to those performed by the lymphnodes for the lymph.

Materials and Methods

The present study was conducted on spleens of 6 camel (irrespective of sex and age). The fresh samples of the spleen from the apparently healthy sacrificeddead camels (irrespective of sex and age) were procured just after their death, from Veterinary Clinical Complex, CVAS, Bikaner. IAEC (Institutional Animal Ethics Committee) approval of present investigation was given by IAEC of College of Veterinary and Animal Science, Bikaner as per CPCSEA norms vide order No. CVAS/IAEC/2017/06 dated 30/11/2017.

Gross anatomical studies

Gross anatomical studies of the spleen were done forShape and colour, measurement of size (length, width and thickness), measurement of volume and weight and topographical study. Weight was taken with the help of electrical balance, volume was measured by water displacement method by measuring cylinder and length and width were measured by thread and measuring scale at the longest and widest portion of the organ. Thickness was measured by Vernier's Calipers at different regions.

Results and Discussion

The spleen is a single, largest lymphoid ductless gland in the body (Bello *et al.,* 2019).In the present study, it was observed that the camel spleen was situated in the left dorsal part of the abdominal cavity, just above the dorso-caudal face of the rumen, and its anterior portion was firmly connected to it by a small triangular area by gastrosplenic ligament. It was reaching up to the pelvic inlet and extending obliquely from the anterior border of the seventh lumber transverse process to the posterior border of the third lumbar transverse process. It differed greatly in structure and position from that of other domesticated animals as it was much smaller in proportion to the body weight and size. The crescent shaped spleen of camel having a head, a body and a tail as reported by Zidan *et al.* (2000). Whereas, Maina *et al.* (2014) and Nawal *et al.* (2018) reported C shaped spleen in camel and semilunar fetal spleen by Alhaji *et. al.* (2019). Contrary to thisin sheep and goat the spleen was elongated and elliptical (Getty, 1975 and Awal *et al.*, 1991a) and triangular (Thanvi, 2002; Gnanadevi *et al.* 2019). Musk deer had compact oval shape (Khan *et al.,* 2006), long slipper shaped in African giant pouched (Ibe *et al.,* 2019), oval in assamese indigenous fowl (Baishya and Bhattacharyya 2012), like huge, curved, flattened, elongated spleen in clouded leopard (Doley, 2014), elongated elliptical in water buffalo as reported by Rashad *et al.* (2021).

These findings were similar to the observations as noticed by Bello *et al.* (2019), Nawal *et al.* (2018), Elsayed (2019), Tharwat (2020), in camel while Alhaji *et. al.* (2019) stated that spleen located ventrocaudal to the diaphragm, as an attachment on the left craniodorsal aspect of the rumen. The spleen of bovine extended downward and forward from the upper part of the last two rids to the level of sixth rib (Getty, 1975 and Awal *et al.*, 1991a). The long axis of spleen of sheep was oblique and corresponded to the line drawn fromventral end of last rib to the middle of length intercostal space Bello *et al.* (2019).

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Shape and colour

In the fresh state the spleen of camel was soft and elastic but not yielding and presented a dark brown colour as described by Maina *et al.* (2014), Nawal *et al.* (2018) and Alhaji *et al.* (2019) of camel spleen. It was hard in consistency indicating the large amount of interlobular connective tissue as earlier described by Zidan (2000) (Figure). However, a bluish red or somewhat purple red or somewhat purple colour has been reported in horse (Getty, 1975), cattle (Getty, 1975 and Awal *et al.,* 1991a), in sheep (Awal *et al.*, 1991 b). The colour of spleen was reddish-brown which was reported by Getty (1975) in pig, by Khan *et al.* (2006) in musk deer, by Baishya and Bhattacharyya (2012) in Assamese indigenous fowl. According to Thanvi (2002) in sheep and Devi (2012) in Marwari goat the colour of spleen was bluish red to dark purple while, bright red in rabbit Alboghobeish (2012), dark brown in gazelle by Muslih and Mirhish (2017), bright purple color in water buffalo by Rashad *et al.* (2020).

Measurements

(i) Weight - In present study, the average spleen weight was recorded as 365 gm. On the contrary it was 350gm in pig according to Getty (1975) while 100gm in sheep (Getty, 1975), 50.72±2.68 gm in indigenous sheep as reported by Awal *et al.* (1991a), 65-70gm in goat (Khan *et al.,* 2006), 39.57 gm in sheep by Thanvi (2002).

(ii) Volume - During present study, the average volume of spleen was 470 ml, whereas, the average volume of spleen in sheep was 30.16 ml according to Thanvi (2002), in Marwari goat was 36.974 ml according to Devi (2012).

(ii) Length - The average length of the spleen was recorded as 45cm at the longest portion in present study. On the contrary, it was reported 22.5 to 31.5 cm by Nawal *et al.* (2018). It was measured Getty (1975), 60cm in pig according to Getty (1975). According to Khan *et al.* (2006) the length of the spleen was 9.4-12.4cm in goat and 8.5 to 14cm in sheep, respectively, whereas Awal *et al.* (1991) reported the length of spleen to be 9.75 in indigenous sheep. Thanvi (2002) reported 10.03 cm in sheep, Ibe *et al.* (2010) reported 6.44 mm in African giant pouched rat, Kumari *et al.* (2013) reported 6.52 cm in black buck, Muslih and Mirhish (2017) reported 7.94 cm in gazelle, Suri *et al.*(2017)reported 12.70cm in sheep and 11.48 cm in goat and Rashad *et al.* (2020) reported 43.7 to 45.5 cm in water buffalo.

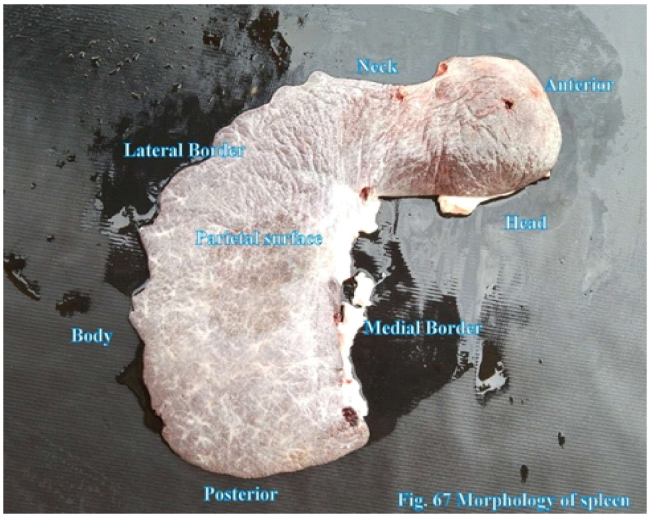

Figure: Spleen of camel

(iii) Width - The width of the spleen during this investigation in the camel was widest at the middle aspect than the dorsal and ventral aspects. The average width of the spleen at widest portion was 14 cm while 8.5 to 14 cm in camel by Nawal *et al.* (2018). According to Awal *et al.* (1991b), the width was 6.91 cm in indigenous sheep. Spleen width was reported 5.88±0.2 cm in gazelle by Muslih and Mirhish (2017), 9.26 ± 0.38 cm in sheep and 9.37 ± 0.79 cm in goat by Suri *et al.* (2017), 14.5 to 15.5 cm in water buffalo by Rashad *et al.* (2020)

(iv) Thickness-The average thickness of the dorsal, medial and ventral aspect of spleen was 0.595±0.0301cm, 1.213±0.063cm and 0.448± 0.0151cm respectively. Awal *et al.* (1991a) described that the average thickness of spleen of indigenous sheep was 0.810± 0.09cm while Awal *et al* (1991b) reported 1.85 cm in indigenous cattle.

Topography

In the present study, camel's spleen had a hilus, two surfaces, two borders, and two extremities.

(i) Surface- It presented two surfaces which were in accordance with the finding of Getty (1975) in pig. Awal *et al.* (1991b) in indigenous sheep and Khan *et al.* (2006) in goat and Musk deer, Thanvi (2002) in sheep, Gnanadevi *et al.* (2019) in sheep & goat also found two surfaces in the spleen.

The parietal surface was slightly convex and was related to the obliqus abdominis internus muscle and to the left sublumbar region. In the centre, it formed the renal impression for the left kidney. A similar description was reported by Bello *et al.* (2019) and Zidan *et al.* (2000) while Elsayed (2019) reported parietal surface located adjacent to the diaphragm in camel. Khan *et al*. (2006) in musk deer reported dome shaped parietal surface laying against the diaphragm.

The visceral surface was somewhat concave and lay in contact with the dorsocaudal part of the left side of the rumen to which it was attached on its dorso-posterior surface with a small triangular area by the peritoneum. Similar observations were recorded by Bello *et al.* (2019) and Zidan *et al.* (2000). The anterior half was firmly attached to the dorsal curvature of the rumen according to Awal *et al.* (1991a) in indigenous sheep, Thanvi (2002) in sheep, Khan *et al.* (2006) in goat and Musk deer, Devi (2012) in Marwari goat and Gnanadevi*et al.* (2019) in sheep and goat. Visceral surface situated between reticular cranial surface and cranial aspect of the rumenal dorsal sac as reported by Elsayed (2019) in camel at Egypt.

(ii) Borders - In present investigation spleen presented two borders which were in confirmation with findings of Getty (1975) in pig, Bello *et al.* (2019) and Zidan *et al.* (2000). A similar description of the borders Awal *et al.* (1991a) in indigenous sheep. It was contrary to the observations of Khan *et al.* (2006) in goat and Devi (2012) in Marwari goat in that it had four borders while, Thanvi (2002) reported three borders of spleen in sheep.

The lateral border of camel spleen was thin, convex, free and generally irregular in outline due to marked indentations throughout its length. A prominent notch was present anteriorly while posteriorly it terminated into a pointed end as reported

by Zidan *et al.* (2000). The cranial border was thin and free, whereas the caudal border was short, thick, concave, and encircled the left kidney's lateral convex borders according to Zidan *et al.* (2000) in camel. The medial border was folded towards the parietal surface at the hilus on which the left kidney rested and marked a renal impression. Whereas, this border has been reported concave, thick and rounded up to the hilus, thick and rounded up to the hilus, where it become thin up to the level of posterior extremity. According to Khan *et al.* (2006) in musk deer well-marked borders were sharp, cranial border being thickest irregular ventrally whereas dorsally it was more uniform. The caudal border was thin, concave at the dorsal extremity's end, and convex ventrally. The splenic artery entered the organ at the posterior third of this border.

(iii) Extremities- In the current study, the spleen presented two extremities. The anterior extremity of camel spleen was thick and rounded with constricted neck whereas. The posterior extremity was thinner flattened and tapered at the end.

This finding was similar to the observation made by Zidan *et al.* (2000). The Dorsal end lay under the vertebral ends of the three ribs it is related to the stomach in front, the left kidney behind and the left extremity of the pancreas medially. The ventral end was smaller than the dorsal end it lay on the abdominal floor usually in the umbilical region as reported by Getty (1975) in pig. Thanvi (2002) reported that spleen of sheep was triangular in shape with angles rounded off and having three angles. Khan *et al.* (2006) in musk deer reported ventral extremity was pointy and blunt, whereas the dorsal extremity was thick and convex.

(iv) Hilus- In the present investigation, the hilus was in the form of a wide depression was present in the lower third of visceral surface where the blood vessels were placed apart from each other as observed by Bello *et al.* (2019) and Zidan *et al.* (2000). The hilus of camel spleen extended on the visceral surface of the dorsal extremity and along the convex border. According to Getty (1975) bovine hilus was found as a simple impression on the dorsal third of the visceral surface near the cranial boundary, rather than as a groove. Awal *et al.* (1991a) in indigenous sheep, Awal *et al.* (1991b) in indigenous cattle, Thanvi (2002) in sheep, Khan *et al* (2006) in goat and Devi (2012) in Marwari goat reported depression of the hilus on the visceral surface along the angle formed by the dorsal extremity and the cranial boundary. Baishya and Bhattacharyya (2012) in adult Assamese indigenous fowl reported hilus on the medial extended surface.

Conclusion

The camel spleen was situated in the left dorsal part of the abdominal cavity, just above the dorsocaudal face of the rumen, and its anterior portion was firmly connected to it by a small triangular area by gastrosplenic ligament. The spleens of camel appeared dark brown in colour. It was crescent shaped with blunt and rough edges. The average spleen weight was recorded as 365 gm, the average volume of spleen was 470 ml, the average length of the spleen was recorded as 45 cm at the longest portion in present study. The average width of the spleen at widest portion was 14 cm and the average thickness of the dorsal, medial and ventral aspect of spleen was 0.595 cm, 1.213 cm and 0.448 cm, respectively.

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Conflict of Interest

There is no conflict of interest as per my knowledge andbelief since the manuscript is a part of original Ph.D researchwork.

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