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Short Communication

Histological and histometric study on the spleen of Iraqi camel (*Camelus dromedarius*)

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Abstract: The splenic white pulp diameter, the lymphoid follicles diameter, the splenic capsule thickness, and the splenic trabeculae thickness were determined on fifteen healthy Iraqi camel (*Camelus dromedarius*). The average measurements were 592.35±5.23 µm, 279.19±4.85µm,147.43±3.64 µm and 106.5±6.29µm, respectively. In addition, a wide marginal zone surrounded the white pulp and contained sheathed arteries was found. Also, the cross section of the periarterial lymphatic sheath (PALS) containing 3-4 arteries.

Keywords: Camel spleen, histometric study, white pulp, lymphoid follicles, capsule and trabeculae.

دراسة نسيجية وقياسية نسيجية لطحال الإبل العراقية (*Camelus dromedariu*)

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الملخص: أجريت الدراسة على خمسة عشر حيوان من ذكور الإبل العراقيـــــــــة (*Camelus dromedarius*) لدراسة التركيب النسيجي للطحال وحساب بعض القياسات المجهرية علية. حيث كان معدل القياس لقطر اللب الأبيض وقطرالحويصلة اللمفية وسمك المحفظة والحويجزات على النحو التالي 592.35±5.23µm، 279.19±4.85µm، 147.43±3.64µm و 106.5±6.29µmعلى التوالي. كما كانت منطقة marginal zone المحيطة باللب الأبيض واسعة واحتوت على اغمده الشرايين، وفي المقاطع المستعرضة احتوت منطقة (PALS)على3-4 شرايين.

Introduction

The Spleen is the largest lymphoid organ in the body, and the most important organ of immunological defense for blood invasion (Pabst, 1993). The blood parasite, *Trypanosoma evansi*, is the most important disease to affect the Camel (Ngeranwa et al., 1993). Generally, blood parasites are removed and phagocytosed in the spleen (Schnizer et al., 1972; Chen and Weiss, 1973). Immunohistochemical characterization of the splenic compartments has been performed in humans (Timens et al., 1989; Milicevic et al., 1996; Steiniger et al., 1997), bovine (Deleverdier et al., 1996; Keresztes et al., 1996), sheep (Gupta et al., 1998) and rats (Steiniger et al., 1997). Detailed information about the splenic cellular composition is important for the understanding of its immunological role and for the analysis of several diseases, especially trypanosomosis in camels which causes their main health disorders (Ngeranwa et al., 1993).

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The aim of this study was to examine the different histological compartments in the spleen of Iraqi camel (*Camelus dromedaries*).

Material and Methods

The histological structure of spleens from male Iraqi camels (5 years old) was studied. Fresh spleens were collected on the animals directly after slaughter at the slaughter house of Nassiriyah city Iraq and were fixed in 10% formalin. All specimens were prepared for paraffin sections and stained with haematoxylin and eosin (H&E) (Luna, 1960), the histological work was achieved in our Laboratory of Physiology and Histology at the College of Science, Thi_Qar University. The histological structure of spleens was examined, the splenic white pulp diameter, the lymphoid follicles diameter, thickness of the capsule and trabeculae of all samples were measured under microscopy using a micrometer eye piece.

Results

The camel spleen was found to have a thick capsule surrounding the splenic parenchyma of 147.43±3.64 µm. The outermost layer of the splenic capsule was composed of mesothelial cells (Figure 1), and was divided into clearly distinguished outer and inner layers. The outer layer consisted mainly of connective tissue including collagen, elastic and fibroblast and smooth muscle cells. The inner layer was composed predominantly of smooth muscle cells which seem parallel along in the longitudinal section. The capsule was variable in its thickness between the different area (Figure 2). The trabeculae extended from the capsule and branched, so it divided the spleen area to many parts (Figure 3). The average thickness of trabeculae was 106.5±6.29µm, and it consisted of three layers which contain white fibers, fibroblast and smooth muscle cells, Two longitudinal muscle layers were observed and transverse intermediate layer (Figure 4), with very clear space found between the capsule, trapeculae and the parenchyma also (Figure 5).

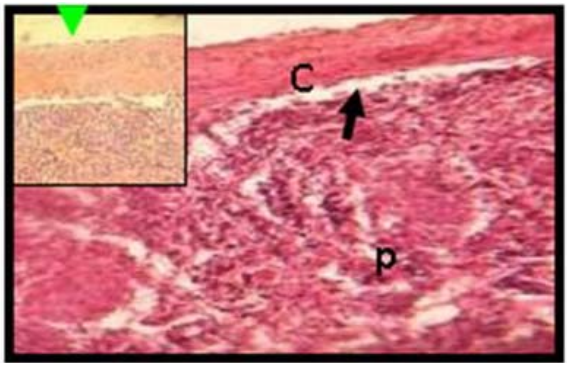

Figure 1. (c) Thick capsule surrounding the splenic area (arrows), parenchyma (P) and, the space (Arrow) and mesothelial cells (arrow head) H&E,169X.

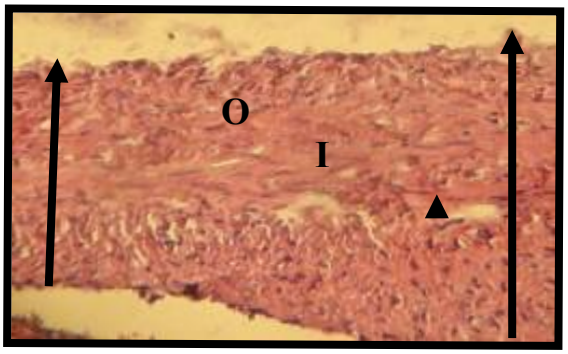

Figure 2. Capsule was variable in its thickness (arrows), (o) outer layer, (I) inner layer, (▲) smooth muscles cell. H&E,200X.

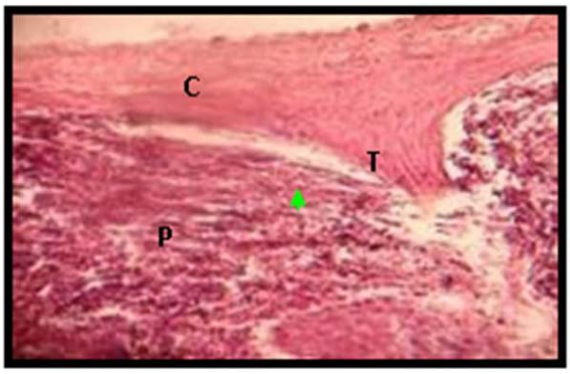

Figure 3. (c) Capsule, (T) trabeculae (p) splenic parenchyma and capsule space (arrow) H&E,169X.

The space between the capsule and parenchyma contained RBC's (Figure 6). The white pulp area was large and its diameter was 592.35±5.23 µm,and of irregular shape, and the (PALS), lymph follicles and the marginal zone were very clear.

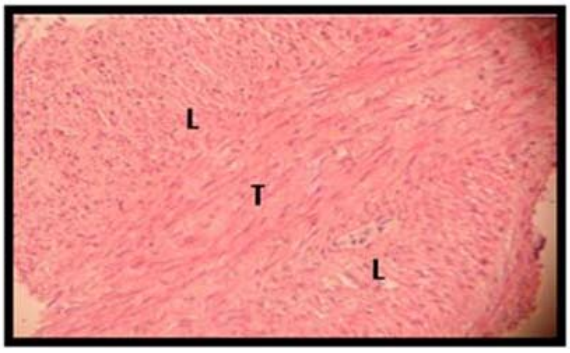

Figure 4. (T) Transverse layer of musucl cells and (L) longitodinal layer of muscles in trabeculae 169X.

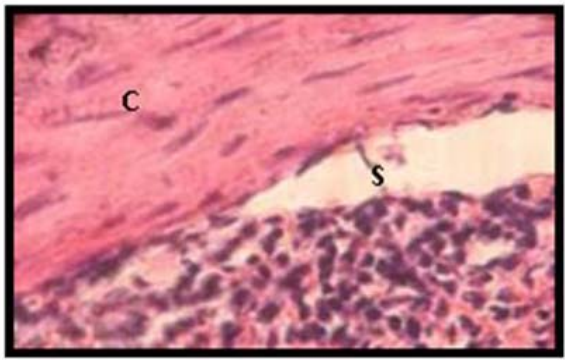

Figure 5. (S) Space between capsule and parenchyma. (C) capsule. E&H.680X

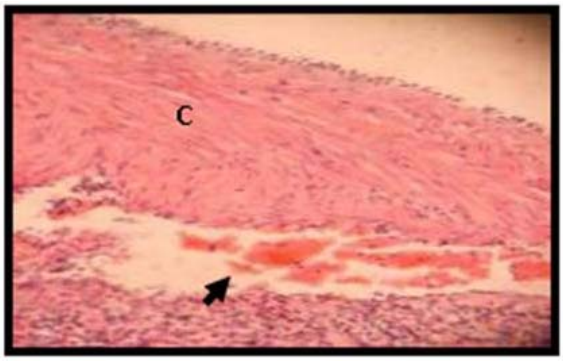

Figure 6. (c) Capsule,and crowd of RBC in space between the capsule and splenic parenchyma (arrow) H&E,169X.

The lymphoid follicles were spherical in shape and their diameter measured 279.19±4.85 µm (Figure 7). The cross section of the PALS contained 3-4 arteries (Figure 8), the artery was tortuous (Figure 9, 10) and branched in PALS (Figure 11).

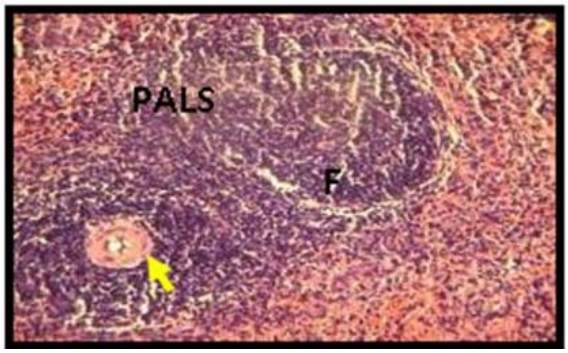

Figure 7. (A) White pulp composed of PALS , a lymph follicle(F)and artery (arrow) H&E,170X.

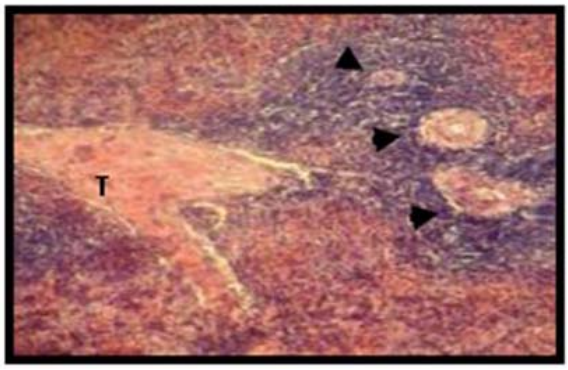

Figure 8. (T) Trabecula and the arteries (arrows head) in the white pulp, H&E,169X.

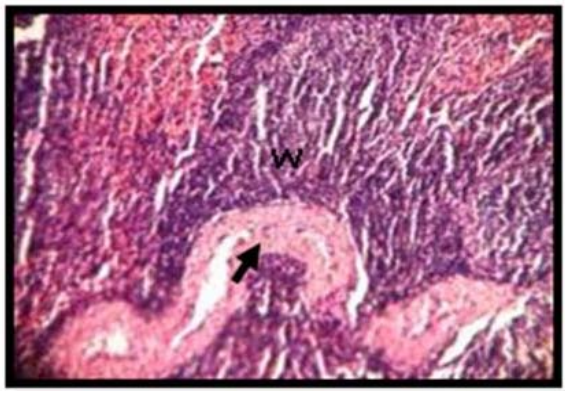

Figure 9. (W) White pulp containing tortuous artery (arrow)H&E,169X.

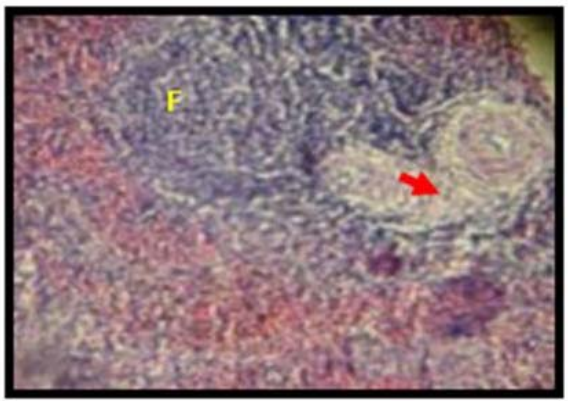

Figure 10. (F) lymph follicle and tortuous artery (arrow). H&E,170X.

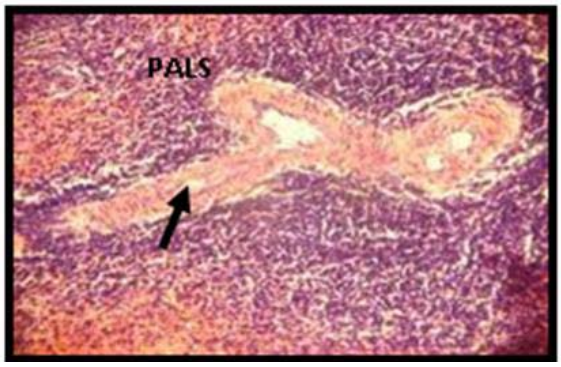

Figure 11.The branched artery (arrow) in the PALS. H&E,170X.

After emerging from the PALS, the central artery branched into 2-5 straight branches (penicillary arteries).A wide marginal zone surrounds the white pulp and it was contained sheathed arteries and smooth muscl cells (Figure 12).

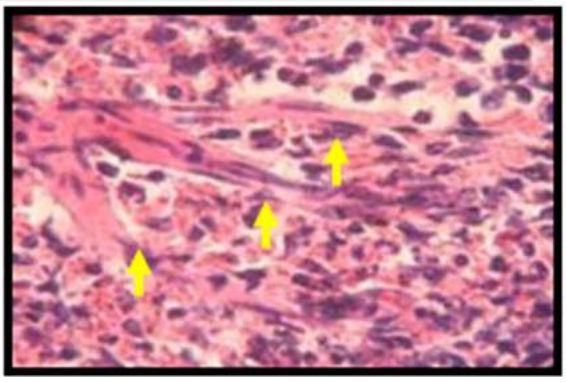

Figure 12. A penicillary arteries (arrows), E&H.680X.

Discussion

This study showed that the capsule of the camel spleen is thick and is divided into an outer connective tissue layer and an inner parallel smooth muscle layer. Cesta (2006) described that the capsule is composed of dense fibrous tissue, elastic fibers, and smooth muscle and showed that the outermost layer of the splenic capsule is composed of mesothelial cells, While in cow and hours they have only 2-3 layers of smooth muscle cells are oriented perpendicular to each other (Bacha and Bacha, 2000). Brown and Dellmann (1976) showed that the capsule of horse consists of an outer thick connective tissue and an inner thinner smooth muscle layer. In the pig, the capsule is formed mainly from smooth muscle, while in the dog and cat smooth muscle cells make up about 2/3 of the capsule thickness. The capsule of the human spleen is composed of connective tissue with little smooth muscle cells (Weiss, 1983; Brown and Dellmann, 1976). The capsule and trabeculae of dogs contains more smooth muscle than that of mice and rats. So, the spleens of rodents do not contract as rapidly and tend to vary less in their gross appearance (Valli et al., 2002). Zidan et al. (2000a) found that the camel spleen is composed of a thick capsule surrounding the splenic parenchyma, and it was divided it to clearly demarcated outer layer, which that consisted mainly of connective tissue including collagen, elastic and reticular fibers with few smooth muscle cells, and inner layer was composed predominantly of smooth muscle cells supported by reticular, collagen and elastic fibers. The thickness of the capsule, trabeculae and concentration of smooth muscles are very important agents to make strong contraction when the body need the blood and the smooth muscle concentration may play a role in the immune reactions, and this agree with what was found by Pinkus et al. (1986) in their study on human spleen, they observed that there is an anticipated immuno reactivity in capsule and trabeculas of spleen and showed that the patterns of localization of smooth muscle myosin are correlated with anatomic structures and possible tissue functions. The white pulp is subdivided into the PALS, the follicles, and the marginal zone. It is composed of lymphocytes, macrophages, dendritic cells, plasma cells, arterioles, and capillaries in a reticular framework similar to that found in the red pulp (Saito et al., 1988). In the camel the white pulp was demarcated by circumferential reticular fibers that is clearly divided the compartments of the white pulp into PALS and lymphoid follicles (Zidan et al., 2000a). In another study, it has been showed that PALS

harbored T lymphocytes, and the marginal zone contained few macrophages and the periarterial macrophages sheath contained many more macrophages than the marginal zone (Zidan et al., 2000b), In immunology field, Muylderman (2001) was discovered unique antibody isotypes in camel serum, which that can interact with the antigen by virtue of only one single variable domain, referred to as VHH, and these heavy-chain antibodies exhibit a broad antigen-binding repertoire by enlarging their hypervariable regions, in another study Muyldermans et al. (2008) found that the serum of the one humped camel was contain anti bodies which that Unlike antibodies from all other species, it was composed of a heavy chain dimer so-called Heavy-Chain Antibodies (HCAb). AL-Busadah (2007) showed that lymphocytes were the predominant leucocytes in blood of three breeds of Arabian camel. Therefore, the large area of white pulp and entity of the tortuous of artery which that supply the PALS area by blood may be play essential role in production blood antibodies.

References

AL-Busadah K. A. 2007. Some Biochemical and Haematological Indices in different breeds of Camels in Saudi Arabia. Sci. J. King Faisal Univ. 8:14-28.

Brown, E. and H.D. Dellmann. 1976. Lymphatic system. In Textbook of Veterinary Histology (Ed. H. D. Dellmann and E. Brown), pp.161-184. Philadelphia: Lea & Febiger.

Bacha, W., J. and M. B. Linda. 2000. Color Atlas of Veterinary Histology. 2nd Ed.

Cesta, M. F. 2006. Normal structure, function, and histology of spleen. Toxicol. Pathol. 34:455–465.

Chen, L. and L. Weiss. 1973. The role of the sinus wall in the passage of the erythrocytes through the spleen. Blood 41:529-537.

Deleverdier, M., N. Abella-Bouges, F. Schelcher, I. Raymond, J. Espinasse and P. Cabanie. 1996. Use of monoclonal antibodies for immunohistochemical study of bovine spleen on frozen sections. Anat. Histol. Embryol. 25:243-247.

Gupta, V., I. McConnell, R. Dalziel and J. Hopkins. 1998. Two B cell subpopulations have distinct recirculation characteristics. Eur. J. Immunol. 28:1597-1603.

Keresztes, G., L. Takacs, P. Vilmos, E. Kurucz and I. Ando. 1996. Monoclonal antibodies detecting components of the bovine immune system in formaldehyde-fixed paraffin-embedded tissue specimens. Vet. Immunol. Immunopathol. 52:383-392.

Luna, L.G. 1960. Manual of Histological Staining Methods of the Armed Forces Institute of Pathology. 3rd ed. by McGraw Book Company. New York, London.

Muylderman, S. 2001. Single domain camel antibodies: Current status. Rev. Mol. Biotechnol. 74:277-302.

Muyldermans, S., T. N. Baral, V. Cortez Retamozzo, P. De Baetselier, E. De Genst, J. Kinne, H. Leonhardt, S. Magez, V. K. Nguyen, H. Revets, U. Rothbauer, B. Stijlemans, S. Tillib, U. Wernery, L. Wyns, Hassanzadeh-Ghassabeh and D. Saerens. 2008. Camelid immunoglobulins and nanobody technology. Vet. Immunol. Immunopathol.128:1-3.

Milicevic, Z., A. Cuschieri, A. Xuereb and N. Milicevic. 1996. Stereological study of tissue compartments of the human spleen. Histol. Histopathol. 11:833-836.

Ngeranwa, J., P. Gathumbi, E. Mutiga and G. Agumbah. 1993. Pathogenesis of *Trypanosoma* (*brucei*) *evensi* in small east African goats. Res. Vet. Sci. 54:283-289.

Pabst, R. 1993. Anatomische und physiologische Voraussetzungen zur Erhaltung der postoperativen Milzfunktion nach milzerhaltenden Eingriffen. Chirurgische Gastro Enterologie 9:19-22.

Pinkus, G. S., M. J. Warhol, E. M. O'Connor, C. L. Etheridge and K. Fujiwara. 1986. Immunohisto- chemical localization of smooth muscle myosin in human spleen, lymph node, and other lymphoid tissues. Unique staining patterns in splenic white pulp and sinuses, lymphoid follicles, and certain vasculature, with ultrastructural correlations. American J. Pathol.123:440-53.

Saito, H., Y. Yokoi, S. Watanabe, J. Tajima, H. Kuroda and T. Namihisa. 1988. Reticular meshwork of the spleen in rats studied by electron microscopy. American J. Anat 181:235–52.

Schnizer, B, T. Sodeman, M. Mead and P. Contacos. 1972. Pitting function of the spleen in malaria: ultrastructural observations. Science 177:175-184.

Steiniger, B., P. Barth, B. Herbest, A. Hartnell and P. Crocker. 1997. The species-specific structure of microanatomical compartments in the human spleen: strongly sialoadhesin-positive macrophages occur in the perifollicular zone, but not in the marginal zone. Immunol. 92:307-316.

Timens, W., A. Boes, T. Rozeboom-Uiterwijk, S. Poppema. 1989. Immaturity of the human splenic marginal zone in infancy: Possible contribution to the deficient infant immune response. J. Immunol. 143:3200-3206.

Valli, V. E., J. P. McGrath and I. Chu. 2002. Hematopoietic System. In: Handbook of toxicologic Pathology (W. M. Haschek, C. G. Rousseaux and M. A. Wallig, Eds.), Vol. 2, pp. 647–679. Academic Press, SanDiego.

Weiss, L. 1983. The spleen. In *Histology*, *Cell and Tissue Biology*, 5th Edn (Ed. Weiss L), pp. 544-568. London and Basingstoke: Macmillan.

Zidan, M., A. Kassem, A. Dougbag, E. Elghazzawi, M. Abdel Aziz and R. Pabst. 2000a. The spleen of the one humped camel (*Camelus dromedaries*) has a unique histological structure. J. Anat. 196:425-432.

Zidan, M., H. J. Schuberth and R. Pabst, 2000b. Immunohistology of the splenic compartme-nts of the one humped camel (*camelus dromedaries*).Vet. Immunol. Immunopathol.74:7-29.